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New Nouveau
Brunswick

Natural Resources and Energy
Minerals and Energy

Mineral Resource Report

New Brunswick's Mineral Industry *1998*

Edited by
Barbara M.W. Carroll

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SUMMARY

The Minerals and Energy Division of the New Brunswick Department of Natural Resources and Energy manages the mineral resources owned by the Crown. Responsibilities include conducting basic geoscientific studies, maintaining scientific and technical data to aid mineral exploration, developing mineral management policies, issuing licences and leases, administering acts and regulations related to minerals and mining, and monitoring mining activities. Staff geologists and engineers work with other government departments, companies, and organizations on matters related to forestry, environment, and construction. The division published approximately 125 maps and 37 reports in 1998.

The Recorder received 163 mineral exploration reports of work during 1998. Prospectors, and exploration and mining companies recorded 2500 claims, mainly in search of zinc, lead, copper, and gold. The focus of exploration in the Bathurst Mining Camp was base metals; outside the camp, porphyry copper/skarn and manto-style mineralization were of interest. In 1998, multiparameter airborne geophysical and stream-sediment survey maps and data were released for Phase I of the Restigouche Project. The Phase II evaluation was carried out in 1998, with results expected to be available in 1999. In southern New Brunswick, platinum/palladium, nickel/cobalt/copper, gold, antimony, base metals, and potash were the focus of exploration. In addition, there was interest in the Province's limestone, aggregate, dimension stone, silica, and peat resources.

During the year, there were 4 producing metal mines and 39 producing nonmetal mines; one company was involved in coal production. Operations remained suspended at the Murray Brook mine (Murray Brook Resources Inc.), the Lake George mine (APOCAN Inc.), and the Mount Pleasant mine (Adex Mining Inc.).

The value of New Brunswick's mineral production for 1998 was $852 217 726, an 11% decrease from the 1997 figure ($953 071 135). The value of production for metals and nonmetals decreased by 12% and 22%, respectively, while the value of fuels production increased by 27%. Reduced production in the nonmetals sector and a sharp drop in the price of zinc accounted for most of these decreases. Compared to mineral production in other Canadian provinces, New Brunswick's production ranked first in zinc, lead, bismuth and peat; and second in antimony, potash and silver. New Brunswick is the only producer of marl.

SOMMAIRE

La Division des ressources minières et de l'énergie du ministère des Ressources naturelles et de l'Énergie du Nouveau-Brunswick est chargée de la gestion des ressources minérales de la Couronne. Parmi les responsabilités de cette division, on note les levés géoscientifiques de base, le maintien à jour des données scientifiques et techniques servant à la prospection minière, l'élaboration de politiques de gestion minière, la délivrance de permis et de baux, l'administration des lois et des règlements relatifs aux minéraux et aux mines ainsi que le contrôle des activités minières. Les géologues et les ingénieurs de la Division travaillent en étroite collaboration avec les autres ministères ainsi qu'avec les représentants d'entreprises et d'organismes, sur les questions relatives à la foresterie, à l'environnement et à la construction. En 1998, la Division des ressources minières et de l'énergie a publié environ 125 cartes et 37 rapports.

En 1998, l'archiviste aux mines a reçu 163 rapports de travaux d'exploration minière. Les prospecteurs miniers ainsi que les sociétés d'exploration et les sociétés minières ont jalonné un total de 2500 claims, surtout pour la recherche de zinc, de plomb, de cuivre et d'or. La prospection dans le Camp de Bathurst a principalement été axée sur les métaux communs; à l'extérieur du Camp, on s'est intéressé au cuivre et aux skarns porphyriques ainsi qu'à une mineralisation en manto. En 1998, des cartes et des données portant sur des études géophysiques aériennes à paramètres multiples et sur le sédiment fluviatile ont été publiées pour la phase I du Projet Restigouche. L'évaluation de la phase II a été menée en 1998 et on s'attend à ce que les résultats soient disponibles en 1999. Dans le sud du Nouveau-Brunswick, la prospection a été concentrée sur le palatine / palladium, le nickel / cobalt / cuivre, l'or, l'antimoine, les metaux communs et la potasse. On s'est également intéressé aux ressources en calcaire, en agrégats, en pierre de taille, en silice et en tourbe de la province.

En 1998, il y avait 4 mines productrices de métaux et 39 mines produisaient des métaux non métalliques, et l'on comptait une entreprise de production de charbon. Les activités à la mine Murray Brook (Murray Brook Resources Inc.), à la mine de Lake George (APOCAN Inc.) et à la mine de Mount Pleasant (Adex Mining Inc.) sont toujours suspendues.

La valeur de la production de minéraux au Nouveau-Brunswick se chiffrait en 1998 à 852 217 726$, ce qui représente une diminution de 11 p. 100 par rapport à 1997 (953 071 135 $). La valeur de la production de métaux et de métalloïdes a diminué de 12 % et de 22 % respectivement, alors que celle de la production de combustibles augmentait de 27 %. La production réduite dans le secteur des métalloïdes et une baisse marquée du prix du zinc sont en grande partie responsables de ces diminutions. Par rapport aux autres provinces canadiennes, le Nouveau-Brunswick se classe premier pour la production de zinc, de plomb, de bismuth et de tourbe; et deuxième pour celle d'antimoine, de potasse et d'argent. Le Nouveau-Brunswick est le seul producteur de marne au Canada.

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CHAPTER 1.
GOVERNMENT ORGANIZATION AND PROGRAMS

MINERALS AND ENERGY DIVISION

Donald E. Barnett, Assistant Deputy Minister

The New Brunswick Department of Natural Resources and Energy is responsible for managing the province's mineral and energy resources. In addition, it is the provincial agency responsible for mineral and energy policy.

The Minerals and Energy Division manages all matters related to mineral and energy exploration, mine development, mineral processing and mine reclamation. The division also promotes the mineral and energy resource potential of the province, encourages exploration and extraction and the efficient use of energy. The mission of the division is to "identify and manage mineral and energy resources and optimize their economic contribution while sustaining environmental quality."

The Mineral Policy released in December 1993 and the Energy Policy of December 1990 form the basis of government's commitment to the long-term management of minerals and energy resources and support for development of each sector in a manner to both increase and sustain the economic value for present and future generations, whilst ensuring protection of the environment.

In 1998, the Geological Surveys Branch initiated a program review. The Branch's current mandate, activities, partnerships and client needs will be assessed in order to formulate a strategic plan.

The Restigouche Project, begun in 1997 (Phase I) to evaluate the mineral potential in part of Restigouche County, continued in 1998 with Phase II, the assessment of results from Phase I geochemical and airborne geophysical surveys. The evaluation report will be published in 1999. The Province funded Phase I ($540 000) and Phase II ($50 000). A proposal for funding of Phase III will be submitted to the Regional Development Commission in 1999.

The New Brunswick Exploration Assistance Program (NBEAP), supported by federal-provincial funding, ended in 1997. As a result of an internal evaluation that concluded that Program goals had been met, the Province approved NBEAP funding for 1998-99 in the amount of $350 000. The remainder of the 1997-98 NBEAP budget ($61 722) was added for a total budget of $411 722 for the year. The Program continued to be administered by the Department of Natural Resources and Energy.

The Minerals and Energy Division (Figure 1a to 1d) consists of two branches, Geological Surveys and Mines and Energy. In 1998, Rao Irrinki became Director of Geological Surveys.

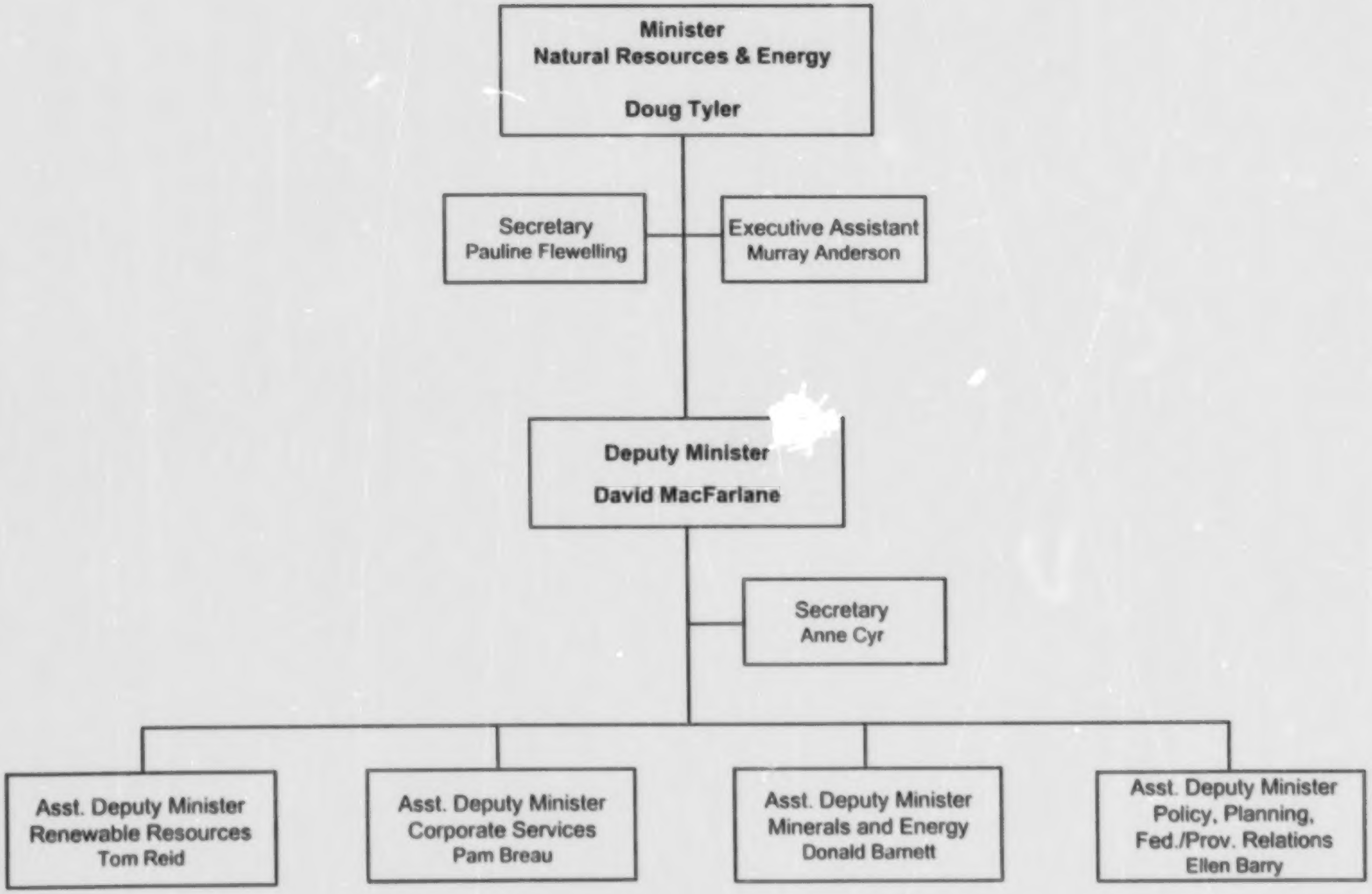


Figure 1a. Organization chart for the New Brunswick Department of Natural Resources and Energy (December, 1998).

Minerals and Energy Division

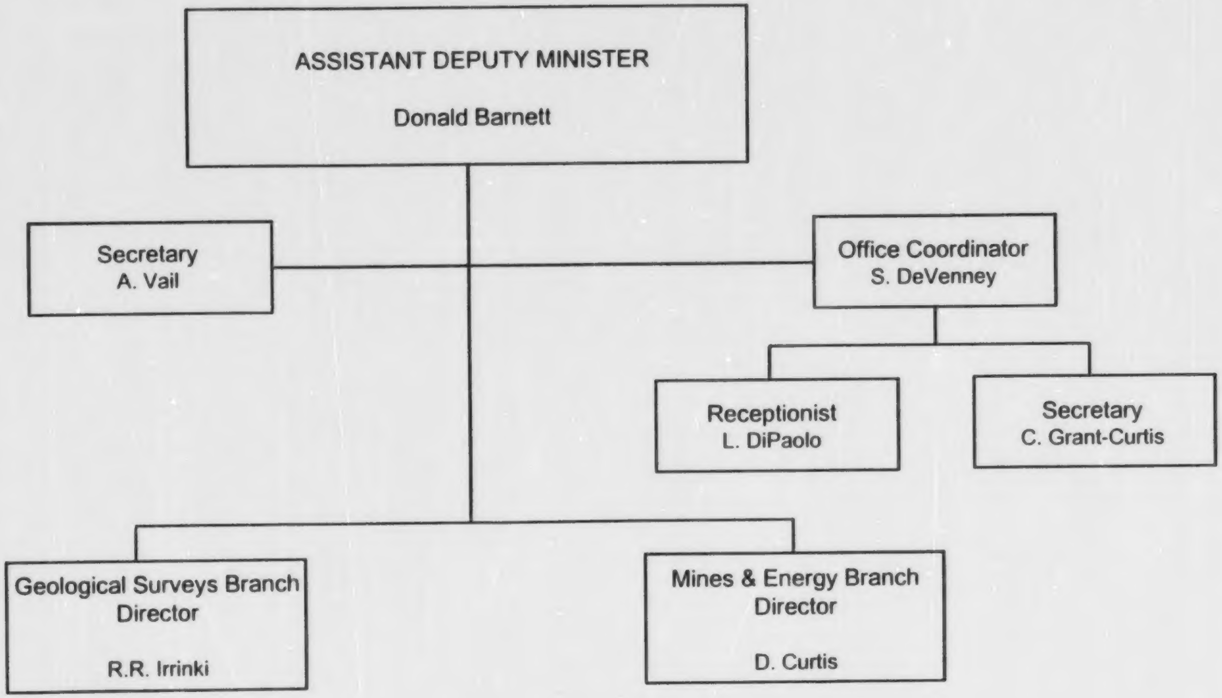
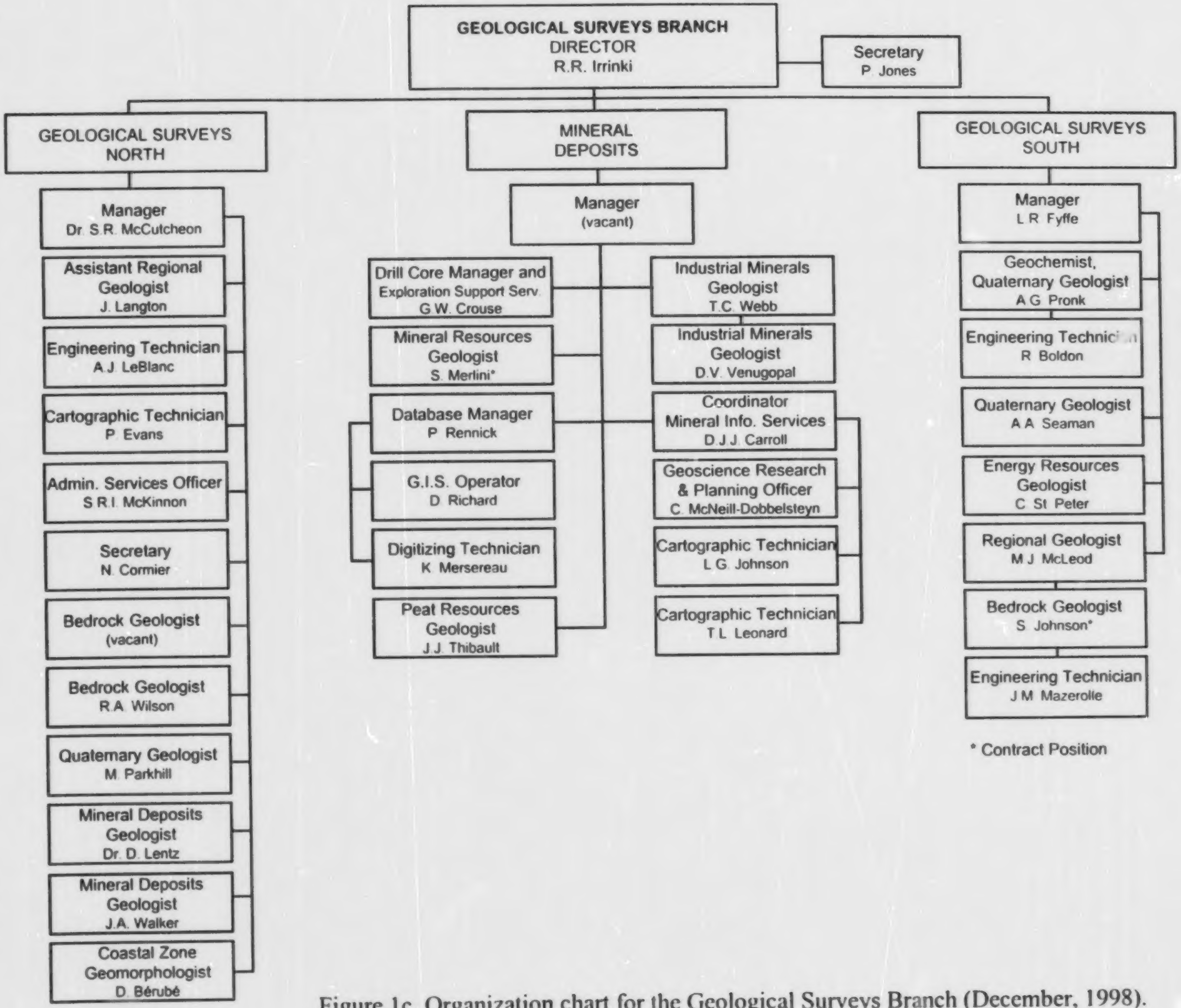
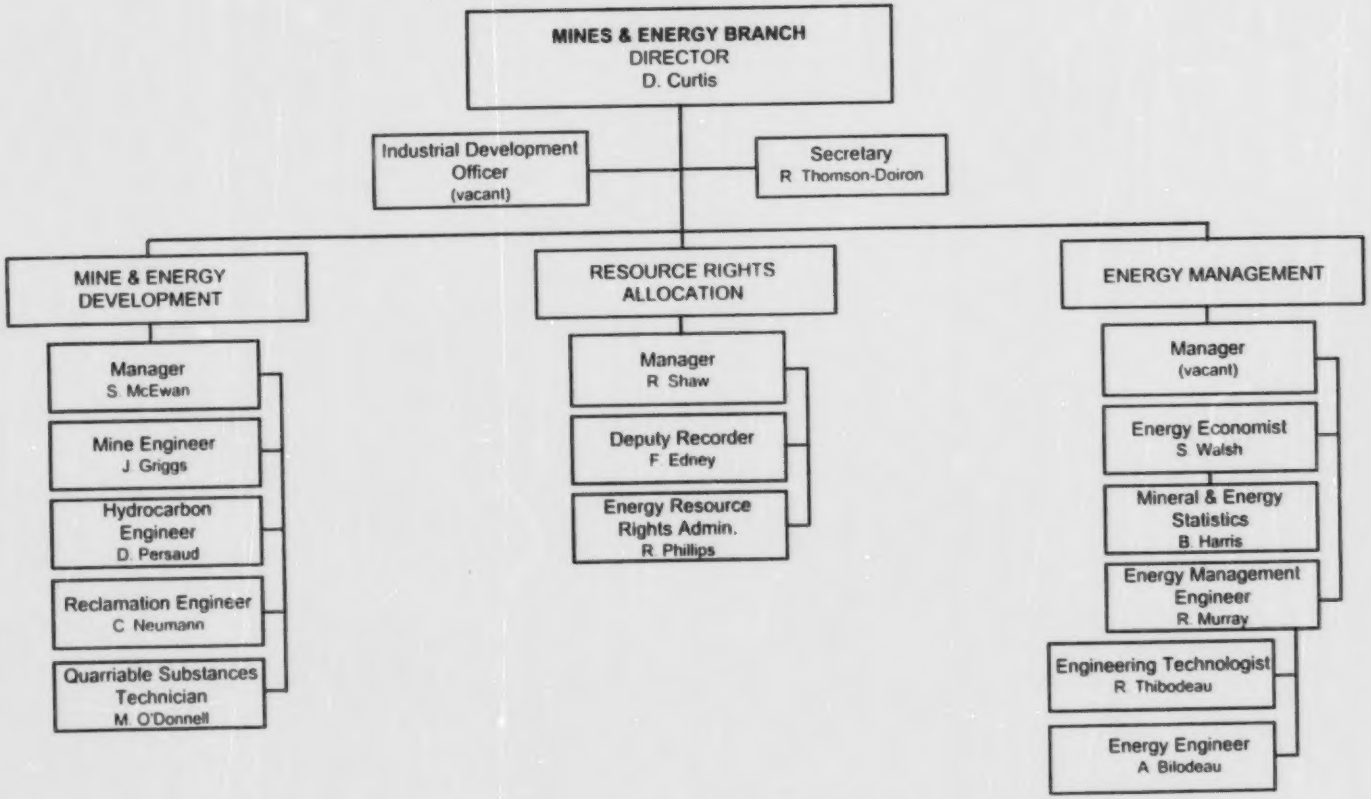


Figure 1b. Organization chart for the Minerals and Energy Division (December, 1998).



* Contract Position

Figure 1c. Organization chart for the Geological Surveys Branch (December, 1998).


MINES & ENERGY BRANCH
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D. Curtis
Industrial Development Officer (vacant)
Secretary R Thomson-Doiron
MINE & ENERGY DEVELOPMENT
Manager S. McEwan
Mine Engineer J. Griggs
Hydrocarbon Engineer D. Persaud
Reclamation Engineer C. Neumann
Quarriable Substances Technician M. O'Donnell
RESOURCE RIGHTS ALLOCATION
Manager R Shaw
Deputy Recorder F. Edney
Energy Resource Rights Admin. R Phillips
ENERGY MANAGEMENT
Manager (vacant)
Energy Economist S. Walsh
Mineral & Energy Statistics B. Harris
Energy Management Engineer R. Murray
Engineering Technologist R Thibodeau
Energy Engineer A Bilodeau

Figure 1d. Organization chart for the Mines and Energy Branch (December, 1998).

Table 1. Minerals and Energy Division Expenditures, 1998–99

Provincial	
Mines and Energy Branch	$3 140 307.88
Geological Surveys Branch	2 111 013.35
Total	**$5 251 321.23**
C–N.B. Cooperation Agreement on Economic Diversification	
New Brunswick Exploration Assistance Program	19 383.83
Airborne Geophysical Survey—Restigouche	4 545.00
Province of New Brunswick (RDC-managed Economic Development Fund)	
Airborne Geophysical Survey—Restigouche	46 718.37
New Brunswick Exploration Assistance Program	317 252.34
Province of New Brunswick (RDC capital budget)	
Drill Core Program	24 999.60
Province of New Brunswick (Human Resources)	
Drill Core Program	6 000.00
Total	**$418 899.14**

The 1998–99 expenditures from the Division's A-base budget, from other provincial funds, and from Federal/Provincial agreements are summarized in Table 1 and Figure 2. Scientific, technical, administrative, and casual personnel employed by the Province in support of its mineral resource totalled 57 for 1998–99.

Clientele of the Minerals and Energy Division are primarily mineral and energy resource companies, consultants, and associations. As well, many government departments and agencies and other resource-related industries utilize the geoscientific information generated by staff. In addition, staff provide direct advice into many government decisions on minerals and energy production and use at interprovincial and national levels. The Division continues to subscribe to the objective of providing quality service to all clients, delivered in an efficient and cost-effective manner.

Editor's Note: Projects commonly consist of a number of phases that are carried out by staff from different sections and branches of the Division. In order to find all the information on particular projects mentioned in the remainder of this chapter, please refer to the index; the list of references for publications completed in 1998 is at the end of Chapter 1.

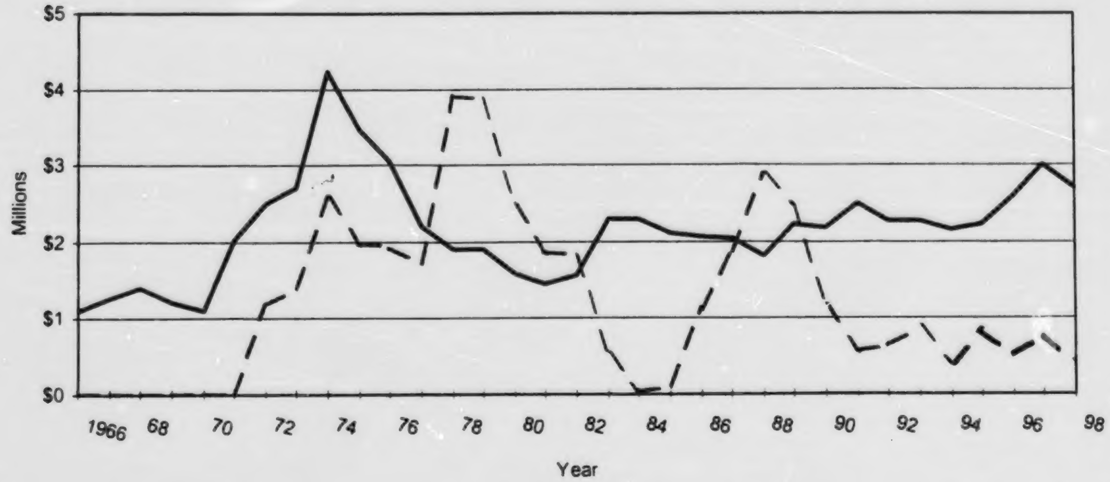


Figure 2. Minerals and Energy Division expenditures, 1965 to 1998, excluding those of Energy Branch. Legend: ——— Department A-base; - - - - - Federal/Provincial/other funding. ($1986 = 100)

Geological Surveys Branch

Rao R. Irrinki, Director

The Geological Surveys Branch is responsible for building and maintaining a comprehensive geoscience database for the province and using it to assist mineral exploration and development, as well as to advise government and the public regarding land use. The branch has a staff of 35 and 2 regional offices, one in Bathurst and the other in Sussex. The Regional Offices provide direct contact with the mineral industry based in northern and southern New Brunswick, respectively. The major activities of the branch are geological mapping, mineral deposit studies and inventory, geophysical and geochemical surveys, management of exploration assistance programs, and distribution and maintenance of geoscience information. The specific responsibilities of the branch are: (a) to map and publish the bedrock geology and surficial geology of New Brunswick; (b) to maintain an up-to-date inventory of mineral and energy resources of New Brunswick. These resources include metallic minerals such as base metals, gold, tin and nickel; and nonmetallic or industrial minerals such as potash, gypsum, limestone and peat; and energy resources such as oil and gas, bituminous shale and coal; (c) to assist the mineral and energy industry in its search for mineral and energy deposits by developing exploration models, identifying areas for exploration and development and providing a geoscience knowledge base; (d) to map coastal geomorphology and investigate environmental sensitivities of the coastline; (e) to review and process all applications for peat exploration licences and peat leases under the *Quarriable Substances Act*; (f) to manage drill core, exploration assistance programs and mineral exploration reports of work; (g) to computerize and maintain geoscience and mineral data by using the Geoscience Information System (GSIS); (h) to distribute geoscience (mineral) information and publications; to organize public information sessions related to the mineral and energy industry; promotion and public awareness of geoscience and the mineral and energy industry; (i) to provide expert advice and consultation on land use planning and environmental issues.

The branch's ordinary budget for 1998–99 was $2 243 700. The branch also received $50 000 from the Regional Development Corporation's (RDC) provincial funding for evaluating the Restigouche Geophysical and Geochemical Surveys, $61 722 Federal/Provincial funding and $350 000 RDC provincial funding for the New Brunswick Exploration Assistance Program, $25 000 from RDC's capital budget for the Drill Core Program, and $6000 funding from Human Resources New Brunswick. Actual expenditures are shown in Table 1. The branch has three sections, namely Geological Surveys North, Geological Surveys South and Mineral Deposits (Figure 1c).

The Geological Surveys Branch initiated a program review in 1998 because its mandate has not been thoroughly reviewed since 1980 when it became a separate branch within the Mineral Resources Division. Further, the activities of various geological survey organizations have changed over the last ten years due to shifting priorities, investment climate, and budget reductions. In Canada, the programs of the provincial surveys and the Geological Survey of Canada have been substantially modified chiefly due to drastic budget reductions. At one time, most of the geological survey organizations were mainly involved in mapping geared to exploration and development but now are more involved in land use planning, public education on geoscience and mining, and studies related to groundwater and environment. Partnerships with industry and universities and linkages with other government departments are helping to raise additional funds to carry out a wider range of programs.

Previous attempts to evaluate the Branch's programs had a rather narrow focus. In 1991, Applied Management Consultants reviewed the minerals mandate from a management and mineral industry perspective. In 1993, the Mineral Policy was released with the main focus being declining mineral reserves in the Bathurst Mining Camp. In 1995, an internal committee of DNRE reviewed the "Minerals Program" and rated the activities carried out by the Geological Surveys Branch. Although this program review clearly identified whether or not the Branch should carry out the activities, it did not address the issue of present and future geological coverage.

The objectives of the program review are as follows:

1. Prioritize geoscience programs and evaluate their effectiveness in attracting mineral exploration and development investment.
2. Identify programs that provide public good and quality of life, through earth science; then identify partnership opportunities with other government departments and agencies to carry out these programs.
3. Review short-term (1–5 year) and long-term (5–10 year) plans for the Geological Surveys Branch.
4. Obtain client input regarding the activities carried out by the Branch.
5. Establish a Geological Surveys Branch mandate that properly reflects its functions.
6. Prepare a strategic plan for the Geological Surveys Branch.

The Program Review was facilitated by dividing the tasks of the Geological Surveys Branch into eight major activities and assigning working groups, comprising Branch staff, to report on the activities for which they were most familiar. The eight working groups are as follows: (1) Bedrock Mapping (Reginald Wilson, Susan Johnson, Leslie Fyffe); (2) Terrain Sciences (Michael Parkhill, Dominique Bérubé, Toon

Pronk, Allen Seaman, Rex Bolden); (3) Metallic Mineral Deposits (David Lentz, Shasta Merlini, James Walker); (4) Nonmetallic Minerals (Jacques Thibault, Timothy Webb, D.V. Venugopal); (5) Hydrocarbon Resources (Clinton St. Peter, Ronald Phillips); (6) Geoscience Information Management (Paul Rennick, John Langton, Barbara Carroll, Terry Leonard, Maurice Mazerolle); (7) Mineral Information Services (Don Carroll, Gregory Crouse, Malcolm McLeod, Steven McCutcheon); (8) Resource Allocation (Ron Shaw, Fred Edney, Ron Phillips).

The guidelines given to the eight working groups were:

1. Future budget increases and decreases will be limited, so be realistic in suggesting new programs. Assume a 20% maximum increase of budget.
2. Examine allocation of resources (financial and human) for each program within the Branch.
3. Define the Geological Surveys Branch's role and responsibilities and linkages with other branches in the Department of Natural Resources and Energy.
4. Identify partnership opportunities (linkages) with other government departments and agencies, Geological Survey of Canada, industry and universities.
5. Identify present map coverage, expected coverage for the next five to ten years, and needed coverage. Identify areas where there is a need for 1:20 000, 1:50 000, 1:250 000, and 1:500 000 scale mapping.
6. Discuss the need for multi-use geological maps (groundwater, land use planning, transportation, tourism, etc.). Does the current mandate satisfy the needs of our clients; if not, how should the province provide these services?
7. List the names, telephone numbers and addresses of present clients. Identify strategies to increase the number of clients.
8. Review the drill-core policy; the Branch is collecting more and more core with very limited budget and needs a strategy to keep appropriate amounts of core.
9. Are the present exploration incentives and promotional events sufficient to attract exploration and development investment to the province? Review these existing programs and identify any changes that are needed.
10. Even with considerable promotion and a reasonable geoscience knowledge base, exploration expenditures and mineral reserves are decreasing. Address the issues surrounding declining exploration and mineral reserves.
11. Discuss the training and technology needs of our staff in order to fulfill our mandate.

CONFERENCES / WORKSHOPS Rao Irrinki gave a presentation at the Division's Review of Activities. He also attended the Annual International Convention and Trade Show of the Prospectors and Developers Association of Canada and the Provincial Geologists' Meeting that were held in Toronto in March; the Mines and Energy Ministers Conference held in Calgary in July; and the Geological Survey of Canada knowledge-base conference held in Ottawa in December.

COMMITTEES Rao Irrinki represented the Minerals and Energy Division on the Provincial Geologists' Committee, National Geological Surveys Committee, and Interdepartmental Committee on Minerals and Energy Issues. He was also a member and co-chair of the coordinating committee of the Memorandum of Understanding between the New Brunswick Geological Surveys Branch and the Geological Survey of Canada.

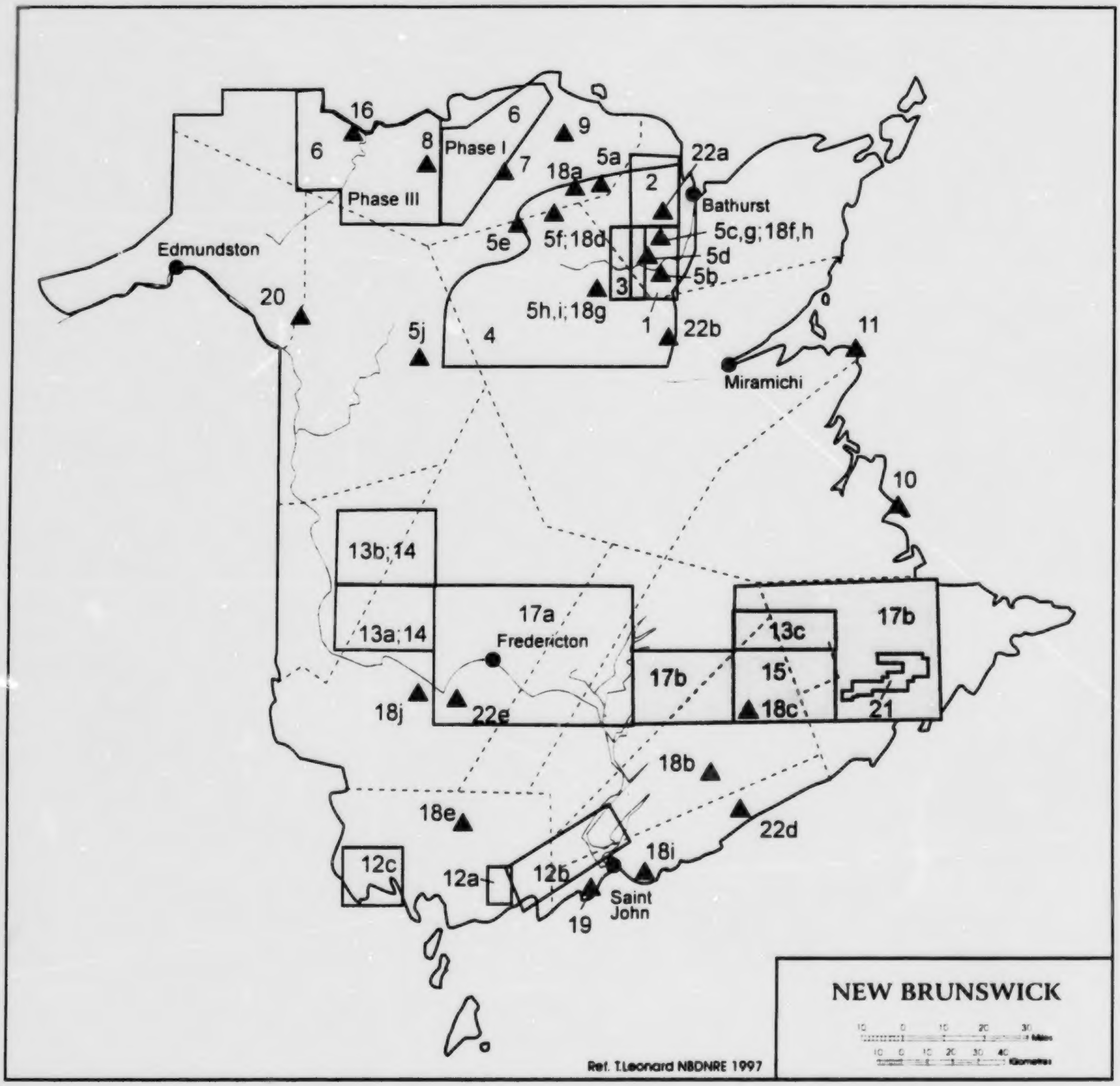


Figure 3. Areas in which some Geological Surveys Branch and Mines and Energy Branch projects were conducted in 1998: (1) surficial mapping, Nepisiguit Falls; (2) surficial mapping, Bathurst; (3) bedrock mapping, border of two map sheets; (4) stratigraphic nomenclature, Bathurst Mining Camp; (5) mineral deposits studies, a. Orvan Brook, b. Flat Landing Brook, c. Headway, d. Louvicourt, e. Restigouche, f. Murray Brook, g. Brunswick No. 6 VMS copper zone, h. Heath Steele area VMS, i. Taylor Brook, j. Sewell Brook–Mount Costigan; (6) Restigouche Project; (7) stream-sediment survey, Popelogan skarn deposit; (8) stream-sediment survey, Boland Brook area; (9) mineral deposit study, Benjamin River South; (10) orthophotogrammetric mapping, Bouctouche Dune; (11) post-glacial beach complex study, Point Escuminac; (12) bedrock mapping, a. Jake Lee Mountain area, b. part of Kingston belt, c. St Stephen deposit; (13) Quaternary geology and till geochemistry, a. Millville, b. Coldstream, c. Salisbury; (14) sample preparation, parts of Millville and Coldstream areas; (15) sample preparation, Petitcodiac area; (16) till and stream-sediment geochemistry, Patapedia area; (17) engineering data on bedrock aggregate samples, a. Fredericton area, b. Moncton area; (18) mine engineering/reclamation issues, a. Caribou, b. Cassidy Lake, c. Plumweseep potash, d. Murray Brook, e. Mount Pleasant, f. Brunswick, g. Heath Steele, h. Brunswick No. 6, i. Cape Spencer, j. Lake George; (19) pipeline monitoring, Lorneville; (20) Saint-Léonard well; (21) Bituminous shale wells; (22) sand and gravel, a. Blue Mountain, b. Shaddeck Lake, c. Hanwell and Sears roads, d. St. Martins.

Geological Surveys North

The purpose of the Bathurst Regional Office is to assist the mineral exploration and peat industries in the northern half of the Province. This is accomplished by: (a) maintaining a complete and readily accessible copy of the geoscience database for the northern half of the Province; (b) gathering new geoscience data, integrating them with existing data and producing new geological maps and mineral exploration models; (c) providing map and report reproduction services as well as exploration work histories on mineral properties; (d) providing claims recording services and claims information; (e) providing geological consultation services/advice to exploration geologists and prospectors; (f) encouraging exploration by promoting the mineral potential of northern New Brunswick through talks, poster displays and geoscientific publications on selected areas and/or topics; (g) helping to maintain the diamond-drill-core library for northern New Brunswick at Madran.

The staff at the office includes Sharon McKinnon (Administrative Services Officer), Nicole Cormier (Secretary), André LeBlanc (Engineering Technician), Phillip Evans (Cartographic Technician), Dr. Steven McCutcheon (Manager/Regional Geologist), John Langton (Assistant Regional Geologist), Dr. David Lentz (Mineral Deposits Geologist), James Walker (Mineral Deposits Geologist), Reginald Wilson (Bedrock Geologist), Michael Parkhill (Quaternary Geologist), Jacques Thibault (Peat Resources Geologist) and Dominique Bérubé (Coastal Zone Geomorphologist). One Bedrock Geologist position was vacant. Peter Banks was hired on contract from January to August to help prepare data for the EXTECH CD-ROM. Marni Dixon, Kay Giggie, Robin Hills, Sean McClenaghan, Kirsten McLaughlin and Kevin Wilson were hired as summer personnel.

EXTECH-II PROJECT This is a cooperative five-year venture focused on the Bathurst Mining Camp and involving the Geological Survey of Canada (GSC), the New Brunswick Department of Natural Resources and Energy, and private industry. This project began in April, 1994 and will end in March, 1999. The provincial component of EXTECH, carried out by the Geological Surveys Branch (GSB), includes subprojects of three kinds: surficial or regolith mapping and sampling; 1:20 000 scale bedrock mapping, and mineral deposits studies. Most of the work conducted in 1998 was of a "wrap-up" nature so none of the project geologists spent the whole summer in the field.

Regolith Mapping and Sampling Michael Parkhill, assisted by Marni Dixon, finished the surficial mapping of the Nepisiguit Falls (NTS 21 P/5) area (Figure 3: 1) in the early summer, thus completing the 1:50 000 scale coverage of the Bathurst Mining Camp. The Bathurst (NTS 21 P/12) map area (Figure 3: 2) was not re-mapped because previous coverage by the GSC (Lamothe 1988) was satisfactory, but was re-interpreted. New exploration trenches were mapped and sampled to assist in the interpretation of the Quaternary history of the Camp.

Bedrock Mapping Revisions to existing 1:20 000 scale geological maps, which were begun in 1997 as a result of the release of the new airborne geophysical maps, continued in 1998 in collaboration with GSC colleagues, Cees van Staal and Neil Rogers. Reginald Wilson was the only person who spent much time in the field and he focused on the Nine Mile Brook area to edge match the California Lake and Nepisiguit Falls (NTS 21 O/8 and 21 P/5) map sheets (Figure 3: 3). Leslie Fyffe and Steven McCutcheon also checked some problem areas in the Little River–Middle River area. John Langton and Peter Banks focused on compiling the geological maps and other data for a CARIS-based CD-ROM. The major result of the summer's work was the standardization of the stratigraphic nomenclature for the entire Bathurst

Mining Camp (Figure 3: 4) and subdivision of the volcanic pile into the more-or-less coeval California Lake, Sheephouse Brook and Tetagouche groups.

Mineral Deposits Studies David Lentz sampled the Orvan Brook, Flat Landing Brook, Headway, and Louvicourt deposits (Figure 3: 5a–5d) for lithogeochemical characterization studies. Some follow-up work was also done on the Restigouche and Murray Brook deposits (Figure 3: 5e–5f) to compliment last year's research. Sean McClenaghan, who began a project under David's guidance last year, finished his sampling of massive sulphides from the major deposits in the Bathurst Mining Camp for petrochemical, multi-element geochemical, and stable and radiogenic isotope studies. This work will constitute the basis for his M.Sc. thesis at Carleton University, which is being supervised by Wayne Goodfellow (GSC). Another one of David's students, Kirk McLellan, completed his B.Sc. thesis at the University of New Brunswick (supervised by David Lentz) in 1998. His thesis is entitled "The Brunswick No. 6 volcanogenic massive sulphide (VMS) Cu-zone, Bathurst Camp, New Brunswick, Canada: petrology, geochemical composition, and petrogenesis." (Figure 3: 5g) Also, Jason Rickard completed his B.Sc. thesis at Carleton University in 1998. His thesis, entitled "Gamma-ray spectrometric applications to volcanogenic massive sulphide exploration in the Heath Steele Mines area, Bathurst Camp, New Brunswick," (Figure 3: 5h) was facilitated by David Lentz and supervised by Richard Taylor (Carleton) and Ken Ford (GSC).

James Walker continued to field check occurrences, mainly within the Bathurst Mining Camp (Figure 3: 4), and enter the data into the Mineral Occurrence Database (MOD). This year he focused on the twenty deposits that are going to be in the Geophysical Atlas of the Camp. He also logged and sampled cores from the Taylor Brook deposit (Figure 3:5i). In addition to his EXTECH work, James is working part time on deposits in the Sewell Brook–Mount Costigan area of the Tobique–Chaleur zone (Figure 3: 5j) for his M.Sc. thesis at the University of New Brunswick.

RESTIGOUCHE PROJECT The objective of the Restigouche Project is to help industry evaluate the potential for copper–gold deposits in porphyry–skarn systems within the Kedgwick zone of predominantly sedimentary rocks (Figure 3: 6). The results of Phase I of this project, a multi-parameter airborne geophysical survey and a multi-element stream-sediment survey over the northeastern quarter of the belt, were released in July, 1998. Phase II of the project involved evaluation of the results from Phase I and was carried out by Kay Giggie, assisted by Kirsten McLaughlin, and in consultation with Robert Shives of the Geological Survey of Canada (GSC). This evaluation included a synthesis of industry responses to the data release and ground follow-up over a six-week period. An interim report (unpublished) that focused on the industry's response was finalized in September. The main conclusions of this report are as follows:

- As expected by the mineral industry, immediate benefits (claim staking and discovery of new mineral occurrences) from the data release were limited. This was attributed to the lack of a producing mine in the area to attract large investors, and a general slump in the mineral industry.
- All industry respondents that were surveyed appreciated the opportunity to comment on the airborne survey data.
- The mineral industry believes the survey data are vital for mineral exploration and discoveries to occur.
- The majority of respondents felt the Restigouche area was well chosen for its mineral deposit potential and the previous lack of high quality, high resolution geoscience data. Industry believes further detailed surveying and mapping is required to upgrade the geoscience database to a level comparable to the adjacent Gaspé region of Québec.

- The majority of respondents agreed that the parameters measured and instrument specifications in the airborne survey provided high quality, high resolution data that will be a significant aid to exploration programs in the area. Industry also feels that the government should be constantly evaluating evolving technologies for airborne systems that could have applications for regional surveys.
- Advance notice of data release delays should be given especially to those who pre-order the data.
- Digital data are more versatile for exploration purposes, but should be more readily available and affordable. Paper maps should be continued as an optional format.
- Ground checking confirmed that airborne data are cost-effective tools for geological and structural analysis needed for effective exploration and mine discovery.
- Vertical-gradient patterns define abundant, previously unrecognized structural detail (folds and faults) and unmapped, small intrusive bodies (dykes and sills) that may have economic significance. A revised structural interpretation will be possible with the present data.
- Radiometric data can be used to detect and clearly discriminate amongst various intrusive phases, including syn-mineralization plagioclase–hornblende porphyry and post-mineralization quartz–plagioclase porphyry.
- Ratio maps show that anomalously low thorium/potassium ratio values are associated with all three of the better known skarn occurrences in the area (Popelogan, McKenzie Gulch, and Charlo River).

A final report that focuses on the ground follow-up results, using a portable gamma-ray spectrometer (borrowed from the GSC) and a magnetic susceptibility meter, will be completed in 1999. These instruments were used to obtain signatures from various rock units (with particular emphasis on felsic intrusions) and to correlate them with the airborne data (with particular emphasis on areas of known mineralization).

Follow-up to the multi-element stream-sediment survey, which was done to National Geochemical Reconnaissance standards, included work in the vicinity of the Popelogan skarn deposit (NTS 21 O/15E) and at 25 sites in the Boland Brook area (21 O/11E) (Figure 3: 7–8). This work was done by Michael Parkhill and Toon Pronk (GSB), Marni Lynne Dickson (UNB) and Peter Friske (GSC) and included a detailed till, humus, and stream-sediment sampling (120 sites) and surficial mapping program.

Also, Kirsten McLaughlin undertook a B.Sc. thesis project, supervised by David Lentz at the University of New Brunswick, entitled the "Benjamin River South porphyry Cu deposit, northeastern New Brunswick." (Figure 3: 9) This deposit is immediately east of the Restigouche survey area.

COASTAL ZONE Dominique Bérubé carried out work with both restoration and research components. In 1998, three projects were undertaken. An inventory of all published reports and maps dealing with coastal erosion in New Brunswick was prepared and entered into a Microsoft Access97 database by Nadine Morris. The database contains a total of 796 sites where coastal erosion rates have been documented. Dominique, with the assistance of André Robichaud, carried on with the orthophotogrammetric mapping of the Bouctouche Dune (Figure 3: 10), which was begun last year. Aerial photos from 1945, 1973 and 1996 have been digitized at high resolution (CARIS) to analyze coastline (dune) and shoreline (beach) changes. He also undertook, jointly with Léa Olsen, a study of a post-glacial beach complex at Point Escuminac (Figure 3: 11). A trench (2 m wide by 30 m long) was dug to describe in detail the sedimentology and stratigraphy of a former sand spit located 11 m above present sea level.

CONFERENCES / FIELD WORKSHOPS The Bathurst staff promoted the geology and mineral potential of northern New Brunswick by displaying posters and giving oral presentations at a number of conferences. James Walker attended and helped man the Geological Surveys Branch display at the Annual

Cordilleran Exploration Roundup in Vancouver in January. Steve McCutcheon did the same at the Annual International Convention and Trade Exposition of the Prospectors and Developers Association of Canada in Toronto in March. He and David Lentz attended the Geological Association of Canada–Mineralogical Association of Canada Joint Annual Meeting in Québec City in May. They helped lead the New Brunswick Prospectors and Developers annual field trip in June. John Langton, Michael Parkhill and Reg Wilson attended the Colloquium and Annual General Meeting of the Atlantic Geoscience Society in Amherst in February. Abstracts for oral presentations and posters at these conferences are listed at the end of this chapter. Steve McCutcheon attended a GSC-sponsored field trip along the lower St. Lawrence River valley in September, which was followed by a GSC-sponsored Laurentian Margin Workshop in Québec City in October attended by Reg Wilson. The purpose of the field trip and workshop was to discuss collaborative work that could be done under a NATMAP Project. In October, Dave Lentz attended the Geological Society of America meeting in Toronto and participated in the Society of Economic Geology short course entitled "Techniques in hydrothermal ore deposits geology."

In March, Dominique Bérubé attended a short course on Engineered Wetlands, which was held at the Lord Beaverbrook Hotel in Fredericton. In April, he presented a talk entitled "Coastal Dune Restoration in New Brunswick: Methods and Results" at the Coastal Dunes Conference, which was held at the Irving Eco-Centre *La Dune de Bouctouche*. In September, he attended the Canadian Association of Geographers (Atlantic Division) Annual Meeting, which was held on the Edmundston campus of the Université de Moncton.

PUBLICATIONS Both internal and external publications were prepared by the Bathurst staff. Of the five papers in "Current Research 1997" (Mineral Resource Report 98-4), two were contributed by geologists from the Bathurst office. Two staff members (D. Lentz and M. Parkhill) authored or co-authored papers in external publications and three staff members (D. Lentz, S. McCutcheon and M. Parkhill) provided one or more critical reviews of manuscripts for geoscience journals.

COMMITTEES In 1998, David Lentz sat on both the New Brunswick Exploration Assistance Program (NBEAP) and Mineral Exploration Stimulation Program (MESP) committees. Steve McCutcheon was a member of the MESP Committee, an Associate Editor of Exploration and Mining Geology, chaired the Examination and Requirements Committee of the Association of Professional Geologists of New Brunswick (APGNB) and became a councillor and Finance Chair of the Geological Association of Canada. Michael Parkhill, James Walker and Reg Wilson were councillors of the AGS. Reginald Wilson was President of the APGNB. Dominique Bérubé participated on the New Brunswick Coastal Zone Committee.

OTHER ACTIVITIES During the year, the staff provided geological consulting and/or exploration support services to geologists and prospectors, both in the office and the field. Many maps and mineral exploration reports of work were reproduced and sold. Visits were made to mineral properties held by the following companies: Breakwater Resources Ltd., Eastmain Resources Inc., Log House Construction Ltd., Major General Resources Ltd., Mountain Lake Resources Inc., Noranda Inc. and Slam Exploration Ltd.

Field trips, office tours and class presentations were given to middle school and high school students by staff members (J. Walker, R. Wilson, and M. Parkhill). Staff also participated in the Job Shadowing and Youth Apprenticeship programs with students from Bathurst High School.

Geological Surveys South

Geological Surveys South staff located at the Hugh John Flemming Forestry Centre in Fredericton consists of Les Fyffe (Manager), Clinton St. Peter (Energy Resources Geologist), Allen Seaman (Quaternary Geologist), Toon Pronk (Geochemist/Quaternary Geologist), and Rex Boldon (Engineering Technician).

Staff at the Picadilly Road office in Sussex consists of Malcolm McLeod (Regional Geologist), Susan Johnson (Bedrock Geologist), and Maurice Mazerolle (Engineering Technician). In addition, Heather Williams (student) and Ivi Turner (office assistant) were hired on a part-time basis.

Geological mapping was carried out in Charlotte County, southern New Brunswick by Les Fyffe who mapped the bedrock of the Jake Lee Mountain area (NTS 21 G/02g) at a scale of 1:20 000 (Figure 3: 12a).

Sandra Barr of Acadia University was partially funded by the Department of Natural Resources while continuing her research and mapping (1:20 000 scale) in the central and southern parts of the Kingston belt (parts of NTS 21 G/1, 2 and 8) (Figure 3: 12b). Also, O. Gaskill of Acadia University (M.Sc. thesis supervised by S. Barr) was partially funded for a new project initiated to investigate the St. Stephen Ni–Cu–Co deposit (part of NTS 21 G/03) (Figure 3: 12c).

SUSSEX REGIONAL OFFICE The Sussex Regional Office was completely renovated in 1998 and was reopened shortly before Christmas. It is now an amalgamated office and houses the Geological Surveys and District Forest Ranger staff. Throughout the year, the staff continued to provide services to the exploration community, engineering firms, academic institutions, other provincial and federal agencies and the general public. Services include ready access to a wide variety of government reports and documents, to the drill-core facility and to technical equipment. Services also include those associated with all aspects of claim staking and recording, geological consultation, and promotion of the mineral potential of southern New Brunswick. The office also provides a base for some of the bedrock mapping conducted in the southern part of the province.

Malcolm McLeod continued compiling 1:50 000 scale bedrock geological maps for the southern part of the province. This included incorporation of new bedrock geological information and updating the New Brunswick Mineral Occurrence Database files. Other work consisted of numerous field trips with colleagues to help clarify geological problems, and with prospectors and company geologists to examine various aspects of the metallogenic environments in southern New Brunswick.

Susan Johnson, assisted by Heather Williams during the summer, conducted 1:20 000 scale bedrock geological mapping in the Nerepis area (parts of 21 G/8c, d and f). This was a continuation of her work studying the stratigraphy, structure and mineralization of the mainly Neoproterozoic, Cambrian and Silurian volcano-sedimentary sequences and intrusive rocks in the New River belt. Following up the previous year's work on the NATMAP Magdalen Basin project, she also conducted studies on the gold potential of Carboniferous rocks in the Memramcook and Sackville areas.

Maurice Mazerolle continued to assist in the preparation of bedrock geological and surficial maps, and in preparing figures and diagrams for presentations and publications. He also initiated a project to compile data from diamond-drill holes and trenches in the southern part of the province. He was assisted by Ivi Turner in the early stages of this project.

CARBONIFEROUS GEOLOGICAL SURVEYS (Clinton St. Peter) During the winter and spring of 1998, the writing of the report on the Carboniferous geology of southeastern New Brunswick continued. The report is being co-authored by Sue Johnson and comprises a geological synthesis of several years of stratigraphical, palynological and structural research. The report is the Department's final commitment under the Canada/New Brunswick-sponsored NATMAP Maritimes Basin Project. The report is expected to be finalized in 1999.

In the early summer of 1998, samples of the Lower Carboniferous (Tournaisian) Boyd Creek Tuff and Upper Carboniferous (Westphalian) Minto Formation volcanics at Cumberland Bay were collected for U/Pb dating. Both volcanic units are well constrained by spore-dated sedimentary beds both above and below and consequently are good candidates for correlating palynological ages with absolute rock ages. The volcanic samples have been forwarded to the Geological Survey of Canada's Geochronology Laboratory in Ottawa where they will be age-dated. This could take one to three years and depends upon the volume of requests previously in the queue.

During the fall of 1998, palynological samples from numerous sites on the New Brunswick Carboniferous Platform were collected and discharged to consultant palynologist Graham Dolby. The samples were taken from problematic beds that have been previously palynologically dated, but with questionable ages assigned. The new palynological age assignments have been received and some of the previous problem ages have been resolved. Further work is required in the remaining poorly dated beds and if time permits this will be undertaken in 1999.

QUATERNARY GEOLOGY (Allen Seaman) Field work for the Quaternary (surficial) geology and till geochemistry project in the Millville (NTS 21 J/03) map area (Figure 3: 13a) of west-central New Brunswick, begun in the latter part of the 1995 field season, was continued in 1998. Field work consisted of surficial geology mapping of most of the map area, and follow-up till sampling around six anomalous areas identified in the original sampling program. Thirteen sites were sampled around the Pb and Pb–Zn anomalies in the Otter Brook–Bear Lakes–Northeast Lakes area (north-central part of the map area); twelve sites were sampled around the Au, As, Cu and Sb anomalies in the Staples Settlement–Wiggins Mills area (southeastern part of the map area); three sites were sampled around the Cu–Mo anomaly in the northeastern corner of the map area; and two sites each were sampled in the vicinity of the multi-element anomalies at Howland Ridge, Pughs Peak and Lower Hainesville. Surficial geology mapping of the area will be completed during the 1999 field season.

Till sampling, on the standard 2 km grid, was also begun in the south-central part of the adjacent Coldstream (NTS 21 J/6) map area (Figure 3: 13b). Twenty-three sites were sampled. Most of these sites lay along the projection of the trend of the suspected As–Sb–Sn–W dispersal train identified in the north-central part of the Millville map area. The objective of this sampling was to confirm the dispersal train, and attempt to determine the source area for the mineralization. Till sampling in the Coldstream area will continue in 1999.

GEOCHEMISTRY LABORATORY (Toon Pronk, Rex Boldon) During the summer of 1998, the southern part of the Salisbury (NTS 21 I/3) map area (Figure 3:13c) was mapped and sampled. A total of 40 sites were sampled; soil parameters, landforms, and vegetation inventory were recorded. Minor "clean-up" mapping and sampling for the Caledonia Highlands was also completed in 1998.

Rex Boldon provided field and laboratory assistance for several surficial mapping projects. He prepared all collected till samples for analyses and carried out grain-size analysis on till samples from surficial mapping in the Bathurst Mining Camp, Restigouche Project, northern Pokiok Batholith, and Caledonia Highlands (Figure 3: 4, 6, 14, 15). Rex has also researched several global positioning sytems and options. Till and stream-sediment sampling were carried out in the vicinity of the Boland Brook and Patapedia areas (Figure 3: 8, 16) of the Restigouche project area in cooperation with the Geological Survey of Canada's Geochemistry Division. The surveys were conducted to the standard of the Geological Survey of Canada's National Geochemical Reconnaissance and were published early in 1998 (Pronk *et al.*1998). This has resulted in further exploration efforts in the area. Another National Geochemical Reconnaissance release covered the northwestern part of map sheet 21 G (Pronk and Boldon 1998).

CONFERENCES / WORKSHOPS / FIELD WORKSHOPS Clint St. Peter and Susan Johnson attended the Nova Scotia-sponsored Carboniferous field trip held in the Parsborro and Joggins areas in August 1998. The purpose of the trip was to acquaint geologists and university students with the strata of mainly the Lower Carboniferous Mabou Group and the disconformably overlying Upper Carboniferous Cumberland Group. The possible marine influence on the coal seams in the Cumberland Group beds at Joggins was discussed during the second day of the trip. The coals at Joggins are somewhat older than the coal in the Minto seam in New Brunswick.

Malcolm McLeod attended the 66th Annual International Convention and Trade Exhibition of the Prospectors and Developers Association of Canada that was held in Toronto in March.

Toon Pronk attended the Geological Association of Canada/Mineralogical Association of Canada meeting in Quebec City, where he presented "A multimedia geochemical survey as a pilot project in the search for skarn and Carlin-type deposits in northwestern New Brunswick" in a special session on skarn mineralization that was organized by Dave Lentz. Directly after the conference, he attended a meeting of the Canadian Geoscience Education Network (a Canadian Geoscience Council committee) of which he is the New Brunswick representative.

PUBLICATIONS A paper on the stratigraphy of the Mascarene Basin co-authored by Les Fyffe of the New Brunswick Department of Natural Resources and Energy, Ron Pickerill, and Peter Stringer of the University of New Brunswick, has been submitted for publication in *Atlantic Geology*.

A detailed study of the Legacy deposit in the McKenzie Gulch area, co-authored by Toon Pronk, Mike Parkhill, and Peter Friske, was published in "Current Research, 1997" (Mineral Resource Report 98-4).

Allen Seaman completed till geochemistry maps for the west half of the Millville (NTS 21 J/3) map area that were released in 1998 (Plates 98-19A, -19B and -19C). A paper based on these till geochemistry results was published in the Division's "Current Research 1997" (Mineral Resource Report 98-4).

COMMITTEES Les Fyffe is on the committee of the Atlantic Geoscience Society that is preparing a book on the geology of the Maritimes to mark the 20th anniversary of the Society. A first draft of " The Last Billion Years" has been completed.

Clinton St. Peter attended the Working Committee meeting of Maritimes Basin NATMAP Project participants in Halifax, Nova Scotia in the spring of 1998. The main topic of discussion was the new proposal by Dr. John Utting of the Geological Survey of Canada (Calgary) that much of the Carboniferous palynological record in the Namurian and early Westphalian of the Maritimes Basin is in serious need of review and apparent revision. In particular, his new critical examinations of continuous sections in Cape Breton and in Joggins implies that beds previously dated as late Namurian to mid-Westphalian are in all likelihood early to late Namurian. In this regard, correlation between the Maritimes Carboniferous and western European Carboniferous are under review and will have a significant impact on our appreciation of the geological history of the coal-, oil- and natural gas-bearing Maritimes Basin.

Toon Pronk continued as Secretary/Treasurer of the Canadian Quaternary Association (CANQUA), a position he will retire from in 1999 after 10 years of service. He is the New Brunswick representative on the Canadian Geoscience Education Network.

OTHER ACTIVITIES Les Fyffe and Steve McCutcheon collected core samples north of Brunswick No.12 in order to assist in the interpretation of stratigraphic relationships within the Tetagouche Group. Traverses were made across the type section of the Little River Formation. A report is being prepared by Les Fyffe and Reg Wilson on the geochemistry and geochronology of Ordovician volcanic rocks in the Big Bald Mountain area.

Throughout the year, Toon Pronk visited classrooms when teachers made requests through the Geological Surveys Branch and the Innovators in the Schools Program. A total of 13 classes, mostly one but sometimes two classes at a time, in 8 different schools (approximately 400 students) were visited. Mostly grade 5 and 6 students learned about rocks and minerals, volcanoes, earthquakes, ice ages, soils, erosion, mining, and earth science in general. The presentation is adapted to fit the "Changes in the Land" earth science module in the science curriculum.

Mineral Deposits

The Mineral Deposits Section consists of the Manager (vacant position), Don Carroll (Mineral Information Services Coordinator), Greg Crouse (Drill Core Manager, Exploration Support Services), Terry Leonard (Cartographic Technician), L. Gerard Johnson (Cartographic Technician), Carol McNeill-Dobbelsteyn (Geoscience Research and Planning Officer), Shasta Merlini (Mineral Resources Geologist), Ken Mersereau (Digitizing Technician), Paul Rennick (Database Manager), Diane Richard (GIS Operator), Jacques Thibault (Peat Resources Geologist), D.V. Venugopal (Industrial Minerals Geologist) and Tim Webb (Industrial Minerals Geologist). This Section is responsible for the New Brunswick Mineral Occurrence Database; Compilation and Publication of "Available Mineral Properties in New Brunswick"; Drill Core Management and Exploration Support Programs; Industrial Minerals; Peat; Computerization of Geoscience Data and GIS-related Projects; Mineral Information Services; and Special Projects.

NEW BRUNSWICK MINERAL OCCURRENCE DATABASE (Shasta Merlini) The New Brunswick Mineral Occurrence Database includes descriptions of metallic mineral occurrences in New Brunswick that range in size from small showings to operating mines. The data recorded include descriptions of the geological setting, geographic location, prospecting history, geochemical and geophysical surveys, trenches and drill holes, assays, and published reserves. Sources of information are listed and include the Division's published geological reports, maps, and unpublished file material, industry assessment reports, Geological Survey of Canada publications, scientific journal articles, and university theses.

Information has been updated for parts of NTS map areas 21 B, 21 G, 21 H, 21 I, 21 O, and 21 P, including available results from the EXTECH-II and NATMAP projects. The New Brunswick Mineral Occurrence Database is updated on an ongoing basis for the entire province.

The database currently uses dBASE file format in a stand-alone DOS-driven program. Future plans may include upgrading to a Windows-based environment. The computerized database contained 802 mineral occurrences when it was first released by D. Rose and S. Johnson in 1990. The second release (April, 1993) included 1284 occurrences with extended information in the form of a separate text file for about one third of those occurrences. The November 1998 release had a total of 1385 mineral occurrences, including text files for the majority. The New Brunswick Department of Natural Resources and Energy will attempt to provide an updated version of the New Brunswick Mineral Occurrence Database annually at the Division's Review of Activities.

AVAILABLE MINERAL PROPERTIES IN NEW BRUNSWICK (Shasta Merlini) The New Brunswick Department of Natural Resources and Energy commonly receives requests for information on available mineral properties in New Brunswick. In addition, prospectors frequently ask if any companies are interested in acquiring properties. The Department, in cooperation with the New Brunswick Prospectors and Developers Association (PDAC), began to compile information on currently active New Brunswick mineral properties in late 1997 for a publication called "Available Mineral Properties in New Brunswick" (Reference 130). The purpose of the report is to actively promote exploration in New Brunswick, encourage interaction within the exploration community, and attract new junior and major mining companies to the province. The publication will be produced annually in November to be distributed at the New Brunswick Department of Natural Resources and Energy's annual Review of Activities in Fredericton. Copies will also be available at the Annual Cordilleran Exploration Roundup conference in January (Vancouver, British Columbia) and the PDAC Annual International Convention and Trade Exhibition in March (Toronto, Ontario).

Letters are sent out in late summer to all current claim holders to request information on their mineral properties. Prospectors and mining companies who would like to promote their properties submit the data to the Department. There is a one-page summary for each property along with a map showing the claim group(s) of interest, surrounding general geology, and any nearby significant mineral occurrences or mine sites. The properties are organized according to general deposit types. Indices are provided at the back to cross-reference property name, prospector/company, contact person, and NTS map area.

DRILL-CORE MANAGEMENT AND EXPLORATION SUPPORT SERVICES (Greg Crouse) The Geological Surveys Branch maintains drill-core storage facilities in Fredericton, Bathurst, and Sussex. The Bathurst facility, located approximately 30 km north of Bathurst at Madran, was built in the mid-1970s with funding from the Canada–New Brunswick General Development Agreement. The Sussex facility, located behind the Regional Office at Picadilly, was built in the 1980s from funding under the Canada–New Brunswick Mineral Development Agreement. The Fredericton core-storage facility was built as part of the Hugh John Flemming Forestry Centre in the late 1980s. All facilities are equipped with well lit viewing rooms and core saws. The facilities are well used by industry and government geologists.

The Geological Surveys Branch received approximately 20 500 m of core in 1998. NovaGold Resources Inc., Teck Exploration Ltd., and Eastmain Resources Inc. were the major contributors at Madran, while Shell Exploration Canada Ltd. was the major contributor at Sussex. The Fredericton facility received a number of engineering core samples from the New Brunswick Department of Transportation. Four new core-storage sheds were constructed at Madran.

Mineral Exploration Stimulation Program (MESP) In 1988, the Geological Surveys Branch introduced the MESP for prospectors. Successful applicants to the program are awarded grants to help defray their prospecting costs. Eligible expenses for the program are analyses, mileage, trenching, geophysics, and geological consulting. Prospectors are not allowed to charge capital expenses or wages to the program. The recipient must provide the Program Coordinator with a sample location map, results of analyses, and receipts documenting expenses in order to receive the final installment of the grant. Applications are reviewed by a committee chaired by Greg Crouse. Members of the Committee in 1998 were M. McLeod, S. McCutcheon, P. Moore, and D. Lentz. They reviewed 35 applications for funding and approved all of them. The MESP budget was $50 000 in 1998 and the largest grant was $1700.

New Brunswick Exploration Assistance Program (NBEAP) This program, funded by the Canada–New Brunswick Cooperation Agreement on Economic Diversification, was introduced in November, 1994. The main objective of the program is to provide financial assistance to junior mining companies in order to increase the probability of finding economic reserves of mineral resources in New Brunswick. This program will provide up to 50% of the project cost to a maximum of $40 000. The minimum amount available per project is $10 000. The remaining costs of the project will be borne by the applicant, either in cash or "in-kind" work. The NBEAP is administered by the New Brunswick Department of Natural Resources and Energy. A review committee, consisting of representatives from both government and industry, evaluate the applications. In 1998, the committee, chaired by Greg Crouse and comprising D. Nowlan, B. Roulston, R. Irrinki, and D. Lentz, reviewed 6 applications and recommended that 3 applicants receive assistance for a total of $19 383.83. This was the final year of the federal–provincial program.

A provincially funded NBEAP program was introduced in 1998 with a budget of $350 000. The objectives and guidelines were the same as the federal–provincial program. A committee chaired by Greg Crouse and comprising B. Roulston, D. Lentz, and M. McLeod, reviewed 17 applications and recommended that 12 applicants receive assistance.

INDUSTRIAL MINERALS (Timothy C. Webb and D.V. Venugopal) In 1998, D.V. Venugopal and Tim Webb completed compilations of selected engineering data related to bedrock aggregate samples collected peripheral to Fredericton (NTS 21 G/15, 16; 21 J/1, 2) and Moncton (NTS 21 H/13, 14, 15; 21 I/2, 3; Figure 3: 17a, 17b) areas. A similar province-wide compilation involving hundreds of samples was initiated as well.

Work began on a re-assessment of New Brunswick's gypsum resources. This involved a compilation and update of geotechnical and related information pertaining to the development potential of selected deposits. An attempt to establish exploration models leading to an improved understanding of the various geologic factors controlling the distribution of these deposits is also being considered.

The province's silica resources were reviewed with special attention given to categorizing the resource, describing selected deposits, and providing preliminary exploration guidelines.

PEAT (Jacques Thibault) The Province of New Brunswick is the principal peat producing area of Canada with about 35% of the national output. In New Brunswick, peat is defined as a quarriable substance and belongs to the landowner. About 70% of potentially commercial peatlands occur on Crown lands, which explains why the provincial government plays a major role in the administration of that resource. The current focus of the province's peat development strategy is on resource allocation, conservation of representative natural peatlands, and restoration of abandoned commercial peat operations.

Guidelines for peat mining operations were prepared to assist industry in planning the commercial development of a peatland so as to minimize adverse impacts on the environment (Open File 98-7). The guidelines are also intended to serve as a tool for government agencies that review, evaluate, or approve such development proposals.

COMPUTERIZATION OF GEOSCIENCE DATA AND GIS-RELATED PROJECTS (M.P. Rennick, K. Mersereau and D. Richard) Staff continued to update databases using the Geoscience Information System (GSIS). The following ten GSIS-related projects were conducted during the year.

Base Maps (M.P. Rennick and D. Richard) Customized 1:20 000 scale base maps were provided to provincial field geologists working on EXTECH-II, Restigouche and other mapping projects, to federal geoscientists, and to industry. These maps were produced by combining Service New Brunswick (SNB) 1:10 000 scale bases and contours from the Digital Elevation Model, and adding updated road network information obtained from Timber Management Branch. These maps contain selected features of the original SNB base.

Airborne Geophysical Survey (M.P. Rennick and D. Richard) The contractor for the airborne geophysical survey over most of the Restigouche project area (Figure 3: 6) provided digital plot files of magnetic, electromagnetic, and radiometric maps in PostScript format. The GIS Section staff have been plotting these maps for clients upon request. To date, more than 200 colour maps were plotted by using these PostScript files. The contractor also provided digital gridded data of various geophysical parameters in XYZ format. These data were converted to CARIS format.

Bedrock Geology Maps (K. Mersereau and D. Richard) Maps for the EXTECH-II, Restigouche and bedrock-related projects were digitized and hard copies were produced for public distribution. A few bedrock geology maps completed before 1990 were also digitized depending upon the priority and availability of digitization resources. The first priority is to digitize all bedrock geology maps produced after 1990. The geology maps for southern New Brunswick were digitized at 1:50 000 scale; these maps are being edited by Malcolm McLeod.

Surficial Geology Maps (K. Mersereau) All the surficial geology maps completed since 1990 are being digitized for public distribution.

Industrial Mineral Maps (K. Mersereau) Eighteen maps, consisting of geology and aggregate resources, were digitized and hard copies were produced for public distribution. These maps are for the cities of Fredericton and Moncton and their surrounding areas.

Digital Mineral Claim Management System Andy LeBlanc has continued to update the mineral claim maps using the Digital Claim Management System. Standard 1:50 000 and 1:150 000 hard-copy mineral claim maps are produced in Fredericton for public distribution and internal use.

Assessment Work Location Maps for New Brunswick These 1:50 000 maps continue to be updated by Ken Mersereau.

Geoscience Publication Indexing System (GPIS): During the initial probing study of the Integrated Mineral Resource Management System (IMRMS), the GPIS was identified as the first priority. Developed in 1996, the GPIS is designed to provide users with a means for quickly searching a large database containing publication information. Included is geoscience information on New Brunswick published by the Geological Survey of Canada (maps and reports), by the mineral industry (mineral exploration reports of work), and by scientific journals (papers). Copies of all publications are held by the Minerals and Energy Division. Queries may include map scales, repository information, authors, subject key words, and prices.

Minimum hardware and software requirements of the system are: IBM-compatible PC with 486 microprocessor, Microsoft Windows 95, 16 MB RAM, hard drive with 500 MB of available space, mouse, SVGA colour monitor, and printer.

By the summer of 1996, the programming was completed and existing data were transferred into the system. Each of the three main databases (list of publications, geoscan index, and bibliography) were edited and updated by Shasta Merlini and Lori Fellows.

Sample and Analysis Subsystem As defined in the IMRMS study, this system will manage all data associated with physical samples collected from the field as well as the results of analyses performed on those samples. As a first step, the system will bring the many existing files containing geochemical analysis data into a common database. It will provide the necessary input, inquiry, and output functions for that database.

The standard structure will accommodate the results of geochemical analysis performed on drill core, water, stream silt, till, and rock samples. This will maximize usability of geochemical data within the Minerals and Energy Division and improve the mechanism for exporting this data to industry clients.

The project team consisted of Greg Crouse (Drill Core and Samples), Chris Gasper (System Analyst), Rao Irrinki (Project Leader), Chris Leadbeater (Database Administrator, Programmer/Analyst), Malcolm McLeod (Lithogeochemistry–Sussex), Toon Pronk (Geochemistry), Paul Rennick (GIS Specialist) and Jim Walker (Lithogeochemistry–Bathurst). The first phase of the project, which detailed the database structure, was completed by September, 1997.

The geochemistry database has been loaded with sample data. The sample data were used to test the importing and exporting utilities. Network connections have been made for Paul Rennick and Toon Pronk in order to carry out final testing.

Similar to the geochemistry database, a geophysical database project was initiated. A project team consisting of Chris Gasper (System Analyst), Rao Irrinki (Project Leader), Chris Leadbeater (Database Administrator, Programmer/Analyst), and Paul Rennick (GIS Specialist), was formed in late 1997. The database was built and tested by Paul Rennick. Custom reporting and input utilities remain to be created.

Mineral Claim Tracking System This system, which utilizes dBase III to manage mineral-claims-related information, was reviewed with respect to the Department's and Division's needs. A project team, consisting of Rao Irrinki, Fred Edney, Sharon McKinnon, Maurice Mazerolle and Paul Rennick representing Minerals and Energy Division, and Roxanne Kierstead and Phil Butland of Information Services and Systems, was formed in late 1997. During the initial meetings, it was decided to upgrade the present system to the Resource Allocation System (RAS), which has been in operation in the Crown Lands Branch. Based on the scope and objectives of the IMRMS, the Resource Allocation System will manage all resource rights, including mineral claims, leases and agreements. The system is now undergoing testing, with the need to create custom reporting utilities.

MINERAL INFORMATION SERVICES The Mineral Information Services (MIS) Section is responsible for providing a variety of geoscientific, technical, and support services to the staff of the Minerals and Energy Division and to the clients of the Department of Natural Resources and Energy. Specifically, the staff provides assistance to the public and the mineral industry by supplying publications on the geology and mineral resources of the Province.

Some of the other functions that the MIS Section is responsible for include publicizing the Division's extensive electronic and hard-copy geoscientific database and promotion of mineral exploration in New Brunswick. The collection and collation of mineral exploration expenditures represents another major activity carried out by this unit. In addition to providing services to the mineral industry and public sectors, the MIS Section also provided cartographic support to the staff of the Division.

Since the transfer of the Geoscience Publications Officer from the Geological Surveys Branch to the Records Management Unit (Information Services and Systems Branch) in late 1996, staff of the Mineral Information Services Section have been working closely with the Public Service Section to ensure that our clients (mainly mining, mineral exploration and engineering sectors) are continuing to receive quality service when it comes to the acquisition of geoscience publications.

Staff of the Mineral Information Services section (Figure 1c) consists of: Donald J.J. Carroll (Coordinator), L. Gerard Johnson (Cartographic Technician), Terry Leonard (Cartographic Technician), and Carol McNeill-Dobbelsteyn (Geoscience Research and Planning Officer). The section is made up of two work units: Geoscientific Cartographic Services and Geoscientific Information Services.

In 1998, very little work was done on the Geoscience Publication Indexing System (GPIS) due to other priorities and minor problems showing up in the results of GPIS queries. An in-depth review of the system is planned for early 1999 by setting up a team of in-house staff from the Geological Surveys Branch's two regional offices and the central office in Fredericton.

Publications An important function of the Geoscientific Information Services unit is the dissemination of geoscience publications to the mineral exploration industry as well as to engineering, consulting, and environmental firms. Although the actual function of assisting clients in the procurement of geoscience data is now the responsibility of the Public Service Section, the MIS continues to monitor our product distribution and client base.

In 1998, approximately 732 requests for geoscience information were answered. The majority of these requests came from three main user groups: the mineral industry, consultant and engineering groups, and agencies of the federal and provincial governments.

Mineral Information Services prepared eight publication notices that were sent to more than 300 clients on our mailing list. These notices publicized 125 plates and 37 geoscience and technical reports. The following is a summary of the contents of the 1998 notices.

February: List of new publications available: 7 maps, 4 reports and 1 Geological Survey of Canada (GSC) report.

April: List of new publications available: 5 maps and 9 reports.
List of digital text files: 6 Open Files.
Timed release of 3 Plates (MP 98-19 A to 98-19C): Till geochemistry of the west half of the Millville (NTS 21 J/03) map area, New Brunswick. Release date: May 26, 1998.
May: Timed release of 1998 multiparatmeter airborne geophysical survey data. 32 maps at a scale of 1:50 000 (MP 98-1A to 98-4H) and 22 at a scale of 1:20 000 (MP 98-5A to 98-15B). Release date: July 7, 1998.
Timed release of 1998 multi-element geochemical survey data. Digital data (OF 98-15 / GSC OF 3617) and 5 maps (MP 98-35 to 98-39). Release date: July 7, 1998.
June: An update to the May notices was sent to extend the pre-order date.
July: List of new publications available: 9 maps and 5 reports.
August: Timed release of 1998 multi-element geochemical survey data (including the gold results). Digital data (OF 98-15 / GSC OF 3617) and 5 maps (MP 98-46 to 98-50). Release date: September 22, 1998.
Timed Release of multimedia geochemical data of the McKenzie Gulch area (parts of 21 O/10, 11, and 15), northwestern New Brunswick. Digital data and text (OF 98-19). Release date: September 22, 1998.
September: List of new publications available: 34 maps and 2 GSC Open Files.
Timed release of regional stream-sediment and water geochemical data for southwestern New Brunswick. Digital data and text (OF 98-18). Release date: October 20, 1998.
Preliminary agenda and registration form for the 23rd Annual Review of Activities.
December: List of new publications available: 3 maps and 7 reports.

The distribution and sale of geoscientific publications from the Fredericton office in 1998 totaled 4655 documents, a 33% increase from the 1997 total of 3491. Staff received 75 requests for photocopies of mineral exploration reports of work, oil and gas lithological logs as well as other hardcopy and microfiche data. These orders represented a total of 3900 pages of text and 522 maps. Revenue generated from the sale of publications and photocopies for all three Division offices (Bathurst, Fredericton, Sussex) in 1998 was $24 447, a 6.7% increase from 1997. More than 82% of the publications sold in 1998 were requested by the mineral industry and engineering sector. Demand for geoscience information in electronic or digital form continues. In 1998, 19 requests were received from 14 separate clients for this type of data. Approximately 100 digital files were ordered resulting in a generated revenue of $1230, of which $250 was forwarded to Service New Brunswick under agreement for the sale of their base maps in digital format. This total revenue figure represented a 58% decrease from 1997 sales.

Mineral Exploration Reports of Work A total of 160 mineral exploration reports of work were filed with the Resource Rights Allocation Section in 1998, which represented an 11.6% decrease from the 181 reports submitted in 1997. The dollar value of work reported in these documents ($ 9 258 273) was up 13% from that reported in the previous year ($8 189 084). To date, 5183 reports of work have been filed with the Resource Rights Allocation Section. They are maintained by Mineral Information Services.

Annual Exploration Surveys Mineral exploration expenditure surveys are carried out by Natural Resources Canada, assisted by the New Brunswick Department of Natural Resources and Energy (Mineral Information Services). The exploration expenditures are collected through two surveys each year. The

Table 2. Summary of Mineral Exploration Expenditure Surveys
(Source: Natural Resources Canada)

Form No.	Survey Name	No. Surveyed	General Exploration	Mine Site Exploration	Total*
Ex-1	Preliminary '97	113	$ 9 800 000	$ 2 400 000	$12 200 000
Ex-3	**Actual '97**	**117**	**9 100 000**	**3 100 000**	**12 200 000**
Ex-1	Forecast '98**	113	7 000 000	1 400 000	8 400 000
Ex-1	Preliminary '98	115	7 000 000	1 600 000	8 600 000
Ex-3	**Actual '98**	**115**	**n/a**	**n/a**	**n/a**
Ex-1	Forecast '99	115	5 400 000	2 000 000	7 400 000

n/a not available
* Survey includes overhead expenditures
** Very little data was obtained from respondents

Preliminary/Forecast in September was followed by the Actual in January. Table 2 summarizes the results of the most recently available surveys. Figure 4 presents historical data on mineral exploration expenditures for New Brunswick.

Public Awareness / Promotion The Mineral Information Section continued to publicize the Minerals and Energy Division's extensive geoscience information base and encourage investment in our mineral resources at several industry conferences in 1998. Meetings such as the 1998 Annual Cordilleran Exploration Roundup in Vancouver, the 66th Annual International Convention and Trade Exhibition of the Prospectors and Developers Association of Canada in Toronto (March) and the 23rd annual Review of Activities in Fredericton (November) were the main targets of our promotion campaign in 1998.

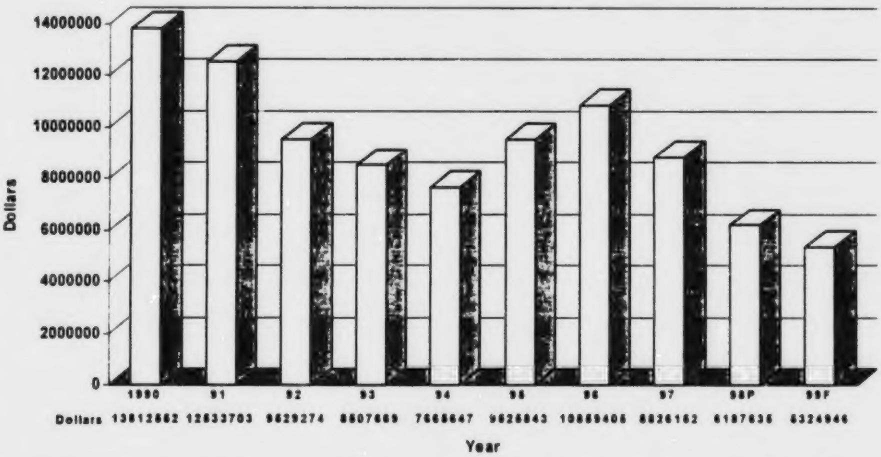


Figure 4. Total annual expenditures (general and mine-site exploration, no overhead) by mining and exploration companies in New Brunswick, 1990 to 1999F. Source: Natural Resources Canada ($1986=100). Abbreviations: P (preliminary); F (forecast)

Attendance by two staff members, James Walker and Don J.J. Carroll, at the Annual Cordilleran Exploration Roundup in Vancouver (January 27–30, 1998) represented the third opportunity for the Division to tap into the western Canadian market as part of its promotional strategy to attract mineral exploration investment dollars to New Brunswick. At this conference, the Department of Natural Resources and Energy showcased a new Geological Surveys Branch promotional exhibit featuring the friendly faces of several New Brunswick prospectors and explorationists. The new display system garnered much attention and compliments from conference delegates.

In addition to Division staff, the New Brunswick delegation at the Cordilleran Roundup included Peter Jamieson, a representative from the New Brunswick Prospectors and Developers Association, who received financial support to attend the Roundup. He was selected because of his poster presentation at the Division's annual Review of Activities and the mineral potential of his property. Several other New Brunswick industry representatives were also in attendance.

The second major conference that the Division attended in 1998 was the Annual International Convention and Trade Exhibition of the Prospectors and Developers Association of Canada, which was held in Toronto on March 8–11. Once again, the venue for the Trade Exhibition was the Metro Convention Centre.

New Brunswick was represented in two exhibit areas. One was the Atlantic Canada Rock Room, a partnership project between the New Brunswick Prospectors and Developers Association (NBPDA), Newfoundland and Labrador Explorationists (NALE), Nova Scotia Chamber of Mineral Resources, and the provinces of Newfoundland, Nova Scotia, and New Brunswick. In addition, the Geological Surveys Branch of New Brunswick Department of Natural Resources and Energy, along with the majority of related provincial and federal agencies, exhibited in an expanded Team Canada location.

The Geological Surveys Branch continued its efforts to financially assist NBPDA members whose mineral properties deserve broader attention and publicity. William Gardiner was the recipient of financial support to attend the 1998 Annual International Convention and Trade Exhibition of the Prospectors and Developers Association of Canada in Toronto, Ontario.

Advertisements / Editorials In addition to attending major industry conferences in 1998, the Division utilized advertisements and editorials to draw attention to New Brunswick's mineral potential.

Advertisements played a key role in the Division's mineral industry investment promotional and public awareness campaign during 1998. The advertisements were run primarily in mineral resource trade journals or newspapers. Both general and target-audience-specific ads were placed in: (1) Mining Review Magazine (January 1998), (2) Miramichi Leader (May 1998), (3) Brunswick East (January 1998), (4) The Telegraph Journal (May 1998), and (5) The Northern Miner (January, March, May, June, September, October 1998). Editorials were published in (1) Mining Review Magazine (Winter 1998) "Government's Attitude A Boon to the Mining Industry" and (2) Prospectors & Developers Association of Canada Digest (March 1998) "Base Metals Still Draw Explorers to New Brunswick."

Review of Activities The 23rd annual Review of Activities of the Minerals and Energy Division was held at the Sheraton Inn in Fredericton on November 2–4, 1998. This year's event commenced with a pre-meeting geological field trip to Freewest Resources Canada Inc.'s Golden Ridge property located in western New Brunswick near Fosterville. The Sunday, November 1 field trip attracted more than 40 participants from various parts of New Brunswick and eastern Canada, including delegates from New York and Maine, U.S.A.

Annual Review '98 commenced on Monday, November 2 with a seminar entitled "VMS deposits into the 21st Century." More than 150 people registered for this session. Presenters included, J.M. Franklin (Franklin Geosciences Ltd.), D. Cranstone (NRCan), B. Simser and R. Schwenger (Noranda Mining and Exploration Inc.), D. Robinson (Eastmain Resources Inc.) and J. Langton (N.B. Geological Surveys Branch). The session was followed by the traditional reception hosted by the New Brunswick Department of Economic Development, Tourism and Culture.

On Tuesday morning, presentations were made by the regional geologists, chairman of the University of New Brunswick Geology Department, and special guest lecturers from the exploration industry. This year, J.W. Davis of Fosters Resources Ltd. spoke on the geology and mineralization of the Devil Pike gold deposit. D. Hoy of Freewest Resources Canada Inc. was the second guest speaker. His subject was the geological setting of gold occurrences in the Fosterville area. The Thursday afternoon and Friday morning programs were devoted to geoscientific talks that concentrated on the results of the EXTECH-II program in the Bathurst Mining Camp. In total, there were 30 presenters from the mineral exploration and mining industry, and the federal, provincial and university geoscience organizations.

This year there were more than 60 exhibitors representing federal and provincial government agencies, the mineral industry, service companies, and the various associations. A commercial trade show sponsored for the third year by the Department of Economic Development, Tourism and Culture, provided New Brunswick companies with an opportunity to promote their products and/or services to the mineral resource sector. Again, there was a strong focus on providing prospectors and junior mining companies with an opportunity to promote their mineral properties in the New Brunswick Core Shack area.

The annual Review of Activities also provides an opportunity for mineral-related groups or associations to hold annual or general meetings. The New Brunswick Prospectors and Developers Association and the Association of Professional Geologists of New Brunswick took advantage of this time period to arrange meetings for their membership in conjunction with the Review.

New at the 1998 Annual Review of Activities was an evening banquet that replaced the traditional noon luncheon. The guest speakers for this event were the Hon. Doug Tyler, Minister of Natural Resources and Energy, and Dr. John McLaughlin, Vice-President in charge of Research and International Cooperation at the University of New Brunswick, Fredericton. Dr. McLaughlin's topic was, "Building a knowledge-based Society in New Brunswick: the geomatics connection." One hundred and forty-five people attended the banquet.

Attendance at this year's Review was 274 registrants, the second highest attendance recorded since 1990. More than 56% of the conference delegates were associated with the resource industry, including the mineral exploration and mining sectors, prospectors, consultants, and service companies.

New Brunswick Mining Week One of the major public awareness activities for the mineral industry in New Brunswick is Mining Week, an annual promotion that was held May 11–17, 1998. The theme was "Mining Makes It Happen." This represented New Brunswick's 9th year of New Brunswick Mining Week celebrations. It coincided with the National Mining Week.

The week's activities were coordinated by the New Brunswick Mining Association. Some of the contributors were: New Brunswick Branch of the Canadian Institute of Mining, Metallurgy and Petroleum; N.B. Coal Limited; New Brunswick Prospectors and Developers Association; communications branches of Natural Resources Canada (NRCan) and New Brunswick Department of Natural Resources and Energy (DNRE); and New Brunswick Department of Education. Displays at malls, special guest speakers, promotional advertisements, open houses, radio and newspaper advertisements, and Mining Week proclamations by local communities were some of the events or materials presented during Mining Week 1998.

To increase the public's awareness of the various Mining Week events, the New Brunswick Mining Association, in cooperation with DNRE Communications Branch, and NRCan, organized a provincial and selected weekly newspaper promotion, called, "The Miner Al Challenge" in which three gold wafers were offered as prizes. The New Brunswick Mining Association funded this project.

In contrast to the usual format of hosting local Grade 6 classes from the Fredericton Area District 18 schools at the H.J. Flemming Forestry Centre as part of Mining Week, DNRE decided to take a break from this activity in 1998. Instead, local geoscientists from industry and government offered their time to visit schools to make presentations. In the Fredericton area, twelve classes took up this offer.

Public Awareness & Promotion Meeting In September of 1998, a meeting of representatives of New Brunswick mineral resource associations (New Brunswick Prospectors and Developers Association, New Brunswick Mining Association, New Brunswick Branch of the Canadian Institute of Mining, Metallurgy and Petroleum), federal–provincial geoscience organizations (Geological Survey of Canada, New Brunswick Department of Natural Resources and Energy), other groups (New Brunswick Department of Education, New Brunswick Museum, University of New Brunswick's Geology Department) and individuals met to discuss public awareness issues.

The objectives of this meeting were three-fold:

1. To bring together key people and organizations that were responsible for or have shown a keen interest in: (a) creating an awareness within the general public (including students) of the importance of understanding basic geoscience principles, and (b) promoting the benefits of mineral industry activity and development to the social and economic framework of today's society;
2. To initiate discussions that would lead to the identification of: (a) what groups and individuals were currently involved with or carry out public awareness/promotion activities associated with the mineral sector, (b) current programs and activities of these groups/individuals, and (c) future plans of these groups/individuals; and
3. To identify partnership opportunities for carrying out promotion and public awareness programs.

This one-day meeting was attended by 16 representatives and resulted in outputs that identified a list of current projects being carried out by these groups, their future intentions concerning public awareness–mineral industry promotion projects, a detailed list of suggestions to improve our knowledge of existing public relations/public awareness products, update current data bases such as the Geoscience Educators of New Brunswick, and improve communications and initiate potential partnerships amongst the diverse resource groups.

SPECIAL PROJECTS The following special projects were conducted during the year:

Restigouche Geophysical and Geochemical Surveys (Rao Irrinki) After the success of the Bathurst Geophysical Survey and the EXTECH-II project, the Geological Surveys Branch, in consultation with industry, spearheaded the Restigouche Project (Figure 3: 6). The project comprises three phases. Phase I calls for an airborne geophysical survey (same specifications as the Bathurst Mining Camp geophysical survey) and a stream-sediment geochemical survey to be carried out over a test block in the northeastern part of the Kedgwick zone. Phase II will consist of an evaluation of Phase I results including follow-up mapping by Geological Surveys Branch staff and will be carried out in 1998–99. Phase III, which involves geological, geophysical and geochemical surveys for the entire Restigouche Project area, will be recommended based on the evaluation of the Phase I results. Phases I, II and III are budgeted at $540 000, $50 000 and $2 200 000, respectively. The rationale for carrying out the project is simple. The northwestern part of the province has not been mapped in detail during the last 20 years. The belt contains rocks similar to those of the Gaspé belt, which hosts several porphyry–skarn deposits including the famous Mines Gaspé mine at Murdochville, as well as numerous gold occurrences. There is also a reasonable expectation that the Restigouche belt could host large, low-grade, Carlin-type (Nevada) gold deposits. The area has one significant mineral deposit, the McKenzie Gulch deposit, which contains 440 000 t grading 1.7% Cu and 10 g/t Ag, and several documented showings. Because only a few claims have been staked in the area, there is good potential to increase exploration in the area.

Phase I was approved in 1997 with provincial funding of $540 000 ($440 000 for the geophysical survey and $100 000 for the stream-sediment geochemical survey). The airborne geophysical survey was contracted to AERODAT Inc., who carried out 10 630 line kilometres of the geophysical survey involving the collection of electromagnetic, magnetic, and radiometric data at a line spacing of 200 m and at a flight direction of N 46° W. Frank Kiss, Ken Ford and Peter Holman of the Geological Survey of Canada (GSC) carried out the field checking. Frank Kiss was also involved in the positioning and processing of the magnetic and electromagnetic data. Rob Shives and John Carson of the GSC were involved in the positioning and processing of the radiometric data. After AERODAT Inc. went into receivership, the department transferred the contract to High-Sense Geophysics Limited, which acquired all the assets of AERODAT Inc. In 1998 more than 100 maps and several digital files were released to the public.

The geochemical survey was contracted to Mactaquac Mining Ltd., which collected 750 stream-sediment samples. Peter Friske of the GSC and Toon Pronk of the New Brunswick Geological Surveys Branch coordinated the geochemistry project. Peter Friske, Toon Pronk and Mike Parkhill also carried out an orientation geochemical survey for the test area. Geochemical survey results were also released in 1998.

Evaluation of Restigouche Geophysical and Geochemical Surveys, Phase II (Rao Irrinki) Phase II, an evaluation of Phase I results, was approved with funding of $50 000. The Geological Surveys Branch hired Kay Giggie to carry out the evaluation. She conducted a client survey on the usefulness of the released data for exploration stimulation, field tested a few geophysical anomalies, evaluated the geophysical data with respect to the underlying bedrock geology, and prepared an evaluation report that is expected to be published in 1999.

CONFERENCES / WORKSHOPS Paul Rennick gave a presentation at the Division's Review of Activities. Greg Crouse and Paul Rennick presented a poster display at the Review.

Tim Webb presented a paper entitled "Industrial rock and minerals: development and opportunities in New Brunswick" at a conference dedicated to Industrial Minerals in Canada, held in Vancouver, British Columbia on October 21–23, 1998. Tim also attended the 9th biennial Federal–Provincial Meeting on Industrial Minerals held concurrently (Oct. 24th 1998) with the Vancouver, Industrial Minerals in Canada conference. The agenda focused on nonmetallic mineral issues facing governments in regard to value-added activities and programs and to the gathering and disseminating of market and related commodity information.

Jacques Thibault attended the Fifth Canadian Workshop on Peatland Restoration held in Québec, at Université Laval, in February. Also in February, Jacques gave a short course on the Quaternary geology of the Bathurst area at the Collège communautaire du Nouveau-Brunswick in Bathurst. In March, Jacques attended a one-day short course on engineered wetlands in Fredericton. The course, presented by Dr. Barry Warner of the Wetlands Research Centre, University of Waterloo, was offered by the Canadian Society for Civil Engineering as part of the 1998 Lecture Tour. Jacques Thibault presented two papers at the international symposium on Peatland Restoration and Reclamation held in Duluth, Minnesota, U.S.A., in July, "Managing Canadian peatlands: status of the resource and restoration approaches" (C. Rubec, Environment Canada, co-author) and "Development of design standards for sedimentation basins" (C.Keats and D. DeMerchant, Gemtec Limited, co-authors). In October, at the invitation of Chinese officials, Jacques Thibault and Dr. Jean-Yves Daigle of the Peat Research and Development Centre (Shippagan, New Brunswick) travelled to northeast China. The purpose of the visit was to meet with peat scientists from the Northeast Normal University of Changchun, government and industry representatives, to discuss issues related to the development of the peat resource. In December 1998, Jacques gave a short course on the many facets of peat and peatlands at the Collège communautaire du Nouveau-Brunswick, Grand-Sault, New Brunswick.

Don Carroll participated in the Annual Cordilleran Exploration Roundup in Vancouver, British Columbia in January and the Annual International Convention and Trade Exhibition of the Prospectors and Developers Association of Canada in Toronto, Ontario in March. In September, he coordinated a meeting of provincial representatives on the subject of geoscience public awareness projects and mineral industry promotion. He was in charge of organizing the Division's annual Review of Activities, held in Fredericton in November. For details, see the Mineral Information Services Section. In December, Rao Irrinki and Don Carroll participated in a 'Canadian Geoscience Knowledge Network' workshop sponsored by the National Geological Surveys Committee that was held in Ottawa.

COMMITTEES Paul Rennick was a member of the Geographic Information System subcommittee. Greg Crouse was the coordinator of the Mineral Exploration Stimulation Program and New Brunswick Exploration Asssistance Program committees.

Jacques Thibault is a member of the Cranberry Task Team, which is chaired by the Department of Agriculture and Rural Development. The task team consists of personnel from key provincial departments and focuses on promoting the development of a cranberry industry in New Brunswick. Several development proposals are associated with peatlands. Jacques is also a member of the committee charged with the development of a new Pits and Quarries Policy for the Province.

EXTERNAL PUBLICATIONS A paper entitled "Industrial rock and minerals: development and opportunities in New Brunswick" was prepared and is to be published in an upcoming special volume on Industrial Minerals in Canada by the Canadian Institute of Mining, Metallurgy and Petroleum.

Mines and Energy Branch

Darwin Curtis, Director

The Mines and Energy Branch is responsible for the allocation and development of the Province's mineral and energy resources in a manner optimizing economic benefits while sustaining environmental quality. It is responsible for fostering a secure supply of competitively priced energy through policy and regulatory activities relating to energy infrastructure and markets. It is also responsible for promoting energy efficiency and air emissions reduction.

The Branch administers the following statutes and their related regulations: *Mining Act; Quarriable Substances Act; Oil and Natural Gas Act; Bituminous Shale Act; Underground Storage Act; Pipeline Act; Gas Distribution Act 1999; Public Utilities Act; Gasoline, Diesel Oil and Home Heating Oil Pricing Act;* and *Energy Efficiency Act.*

COMMITTEES Darwin Curtis is a member of the National Air Issues Coordinating Committee (Climate Change) and attended regular meetings of the committee in Toronto, Ontario in April and July; in Ottawa, Ontario in September; and in Montréal, Québec in December, 1998. He is a member of the National Advisory Council on Energy Efficiency and attended a regular meeting in Ottawa, Ontario in April. He also participated in a meeting of the Ministers of Environment and Energy in Toronto, Ontario in April and in Halifax, Nova Scotia in October. These meetings focused on air emissions, particularly greenhouse gases.

CONFERENCES In April, Darwin Curtis attended the Canadian Energy Research Institute Natural Gas Conference in Halifax, Nova Scotia. In July, he attended the Annual Conference of Mines and Energy Ministers in Calgary, Alberta, and in October, he attended the East Coast Energy Exposition, a market conference and trade show held in Halifax, Nova Scotia.

Resource Rights Allocation

In 1998, Resource Rights Allocation staff (Figure 1d) consisted of Ron Shaw (Manager, Recorder), Fred Edney (Deputy Recorder–minerals), and Ron Phillips (Energy Resource Rights Admin.–oil, natural gas, bituminous shale and underground storage).

Reports of work, submitted to the Resource Rights Allocation Section in accordance with the *Mining Act, Oil and Natural Gas Act, Bituminous Shale Act,* and *Underground Storage Act*, are checked for compliance with the relevant regulations and work credits are applied to appropriate properties. Upon acceptance, the reports are forwarded to the Mineral Information Services staff for microfilming, and storage. Mineral resource allocation and exploration statistics are presented in Table 3 and Figure 5.

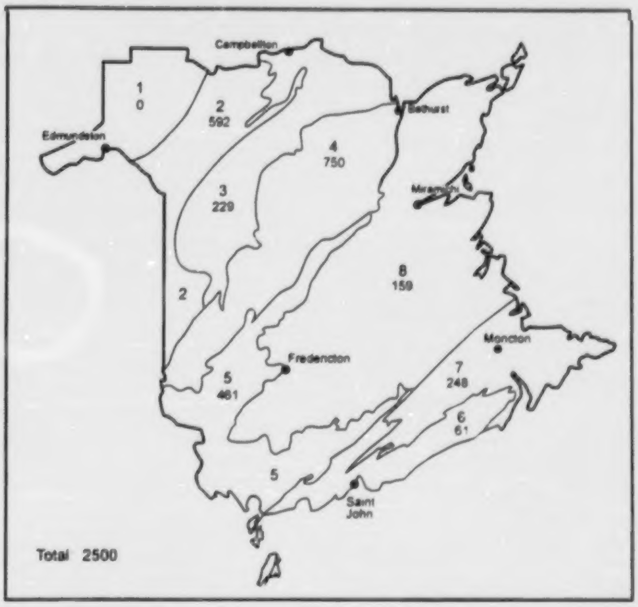
COMMITTEES Ron Shaw attended the annual Provincial/Territorial Mining Rights Committee meeting in Québec on September 23–25, 1998. The committee is an informal forum established to share information regarding mining rights administration across Canada. In sharing such information, it is hoped that each jurisdiction would, over time, develop similar methods for dealing with similar mining rights situations.

Table 3. Mineral Resource Allocation and Exploration Statistics, 1997 and 1998

Mineral Resource Allocation (total in effect at year's end unless specified for the year)	1997		1998	
	Number	Hectares	Number	Hectares
Mining Act				
Prospecting Licences	1 321	---	1 382	---
Claims Recorded (year)	3 360	53 760	2 500	40 000
Claims Renewed (year)	15 447	247 152	15 719	251 504
Claims Expired (year)	3 629	58 064	5 970	95 520
Claims in Effect	21 391	342 256	17 841	285 456
Coal Agreements	5	59 165	5	62 458
Potash Exploration Agreements	0	0	0	0
Potash Leases	2	28 052	2	28 052
Mining Leases	17	12 528	17	12 528
Total Agreements and Leases (above)	---	99 745	---	103 038
Total in Effect	---	442 001	---	389 104
Oil and Natural Gas Act				
Licences to Search	19	411 441.6	29	635 036
Leases	1	2 154	1	2 154
Bituminous Shale Act				
Licences to Search	1	16 165.1	1	24 610
Development Permits	0	0	2	1 077
Leases	0	0	0	0
Underground Storage Act				
Storage Exploration Licences	10	21 258	7	27 920
Storage Licences	0	0	0	0
Construction Permits	0	0	0	0
Quarriable Substances Act				
Quarry Permits	261	---	280	---
Quarry Leases	14	555.39	15	629.62
Peat Exploration Licences (Issued, year)	0	0	2	228
Peat Exploration Licences	3	914	2	228
Peat Leases (Issued, year)	0	0	0	0
Peat Leases	31	12 792	31	12 845
Peat Options (year)	0	0	3	1 067
Peat Options	10	4 157	12	5 022

Exploration Summary	1997		1998	
	Work Reported	Value	Work Reported	Value
Mining Act				
Reports of Work (RW)	178 reports filed	$7 756 461	163 reports filed	$8 136 433
Drilling Reported in RW	202 holes (55 274 m)	$4 033 977	268 holes (57 342 m)	$4 050 278
Potash Exploration	drilling	$165 000	---	0
Oil and Natural Gas Act	---	$133 552.58	2015 ha; 1 well	n/a
Bituminous Shale Act	---	0	5800 ha; 8 wells	n/a
Underground Storage Act	---	0	---	0

n/a not available



Geological zones*:
1. Edmundston
2. Kedgwick
3. Tobique–Chaleur; Elmtree
4. Miramichi North (Bathurst Mining Camp); Miramichi South
5. Fredericton; Passamaquoddy
6. Saint John
7. Moncton Subbasin (Maritimes Basin)
8. Carboniferous Cover (Maritimes Basin)

* This is a simplification of the recently revised terrane map of New Brunswick.

Figure 5. Number of claims recorded, by geological zone, in 1998.

CONFERENCES In May of 1998, Ron Shaw attended the 100th Annual General Meeting of the Canadian Institute of Mining, Metallurgy and Petroleum in Montréal, Québec.

Mines and Energy Development

The Mines and Energy Development Section is responsible for the approvals, operations monitoring, and abandonment and reclamation of mineral and energy resource developments and pipelines. These include mines, pits and quarries, oil and gas exploration and production facilities, pipelines, underground storage and bituminous shale developments. Several section staff are members of the Standing Committee on Mining and Environment, a committee designed to facilitate the mine approvals process. Further processing of resources and value-added opportunities are encouraged through the administration of the Value-Added/Mineral Processing (VAMP) Program. The Section participates in the development and implementation of a broad range of policies and regulations affecting mineral and energy resource and infrastructure development. The Section manager is Sam McEwan.

The Mines and Energy Development Section (Figure 1d) consists of four main components: Mine Engineering, Reclamation Engineering, Hydrocarbon Engineering and Quarriable Substances Administration. The Mine Engineering and Reclamation sections collectively are responsible for the review of feasibility studies, mine plans and reclamation plans, and the monitoring of both active mining operations and inactive mine sites. Hydrocarbon development includes the review and approval of new pipelines, changes to existing pipelines, drilling rigs and BOP (blow out preventor) requirements, and to ensure compliance of existing pipelines and related hydrocarbon activities in the province. The administration of the removal of aggregate resources from Crown land is also the responsibility of this sector and is managed under the *Quarriable Substances Act*. The Mines and Energy Development Section works actively with the Department of Environment through the Standing Committee on Mining and Environment in the review of all mining, energy, and environment-related issues. The sector advances further processing and looks for value-added opportunities within the mineral sector through its Value-Added/Mineral Processing Program (VAMP). This is a program that will cost-share, on a 50/50 basis, eligible projects to a maximum of $30 000.

MINE ENGINEERING John Griggs, the mine engineer, is responsible for work of both a specific and general nature relating to the mining industry of New Brunswick. Responsibilities include the monitoring of mining activities; compilation of technical and mining statistics; administration of the *Mining Act*; review and evaluation of feasibility reports, annual mine plans, and reclamation reports; and administration of projects funded under the provincial VAMP Program. In addition to these specific tasks, the mine engineer liaises with the federal government and other provincial governments on matters related to the mining industry.

During 1998, the mine engineer monitored mine-related activities and reviewed a number of mine plans received in compliance with the *Mining Act* (Section 25, Regulation 86-98). Numerous submissions under the Environmental Impact Assessment Regulation of the *Clean Environment Act* were also reviewed.

Issues requiring the attention of the mine engineer included regulatory requirements related to the suspension of operations at Breakwater's Caribou mine (Figure 3: 18a), which shut down in August 1998 in response to continuing metallurgical problems and depressed metal prices. Potash Corporation of Saskatchewan–New Brunswick Division (PCS) began compacting fine-grained material from Saskatchewan at the newly-acquired Potacan facilities. The Potacan company had been acquired by PCS after flooding caused the closure of the Cassidy Lake mine (Figure 3: 18b) in 1997. In 1998, PCS reported an inflow of water at its mine near Sussex (Figure 3: 18c). Efforts continued throughout the year to identify and eliminate the source of the inflow. NovaGold Resources Inc., the parent company of Murray Brook Resources Inc., decided to close permanently the Murray Brook mine (Figure 3:18d). The copper ore stockpiled on surface for leaching tests was returned to the pit. ADEX's Mount Pleasant project (Figure 3:18e) remained under care and maintenance as prevailing metal prices could not make the mining operation viable. Noranda's Brunswick mine (Figure 3: 18f) inaugurated two major capital projects. In 1998, the company commissioned a paste fill system utilizing tailings to replace rock fill from the company's quarry and installed an autogenous mill in the concentrator. Noranda's other mine in New Brunswick, Heath Steele (Figure 3: 18g), announced that the mine's ore reserves would be depleted by the end of September 1999. Closure-related activities began in 1998, including salvaging of equipment and the implementation of environmental protection measures. Phased layoffs began in the fall of the year. The company, in cooperation with the provincial government and local union, had set up a comprehensive assistance program to help employees make the transition and seek new employment.

HYDROCARBON ENGINEERING The Hydrocarbon Engineer, Don Persaud, is responsible for the review and approval of new pipelines, changes to existing pipelines, drilling rigs and BOP (blowout preventor) requirements, and to ensure compliance of existing pipelines and related hydrocarbon activities in the province.

Pipelines The maintenance and repair program continues on the Lorneville pipeline (Figure 3: 19). A number of additional repairs were completed last year, and the pipeline has operated with no incidence of pipeline leak. To ensure compliance, and to avoid potential pipeline leaks, the maintenance and repair program will continue once again this year. All the additional licensed pipelines have been operating satisfactorily. The two Imperial Oil Limited hydrocarbon pipelines at Courtenay Bay, within the City of Saint John, were pressure tested this year, and the results were satisfactory. Irving Oil Limited has started the rerouting of five pipelines under the Bayside Drive overpass, also within the City of Saint John. This work should be completed in 1999, with the completion of the Lorneville pipeline scheduled for the year

2000. The Department continues to work with Maritimes & Northeast Pipelines on the lateral natural gas pipeline to Saint John, and a potential pipeline to northern New Brunswick. In addition, the hydrocarbon engineer has been monitoring the construction of the main transmission pipeline across New Brunswick. This pipeline is expected to be completed in November 1999.

Drilling MariCo Oil and Gas Corporation did not drill any new wells in 1998, but are expected to drill two more wells in 1999. The Saint-Léonard well (Figure 3: 20) drilled by Mr. Jean Mariadassou turned out to be a dry hole. Shell Canada Limited, with assistance from Three-D GeoConsultants Limited drilled eight wells in the Moncton area for bituminous shale (Figure 3: 21). The results of this drilling are presently being reviewed.

RECLAMATION ENGINEERING The Reclamation Engineer, Cory Neumann, is responsible for departmental coordination of the reviews of mine reclamation and closure plans, annual reclamation progress inspections, and coordination of the provincial mine approval process as it deals with environmental issues, exploration, and mine site audits. In addition, the reclamation engineer liaises with the federal and provincial governments and industry on matters related to mining and the environment. The position was filled on an interim basis by John Griggs up to November 1998.

Issues requiring the attention of the reclamation engineer were Heath Steele's (Figure 3:18g) closure plans, including Stratmat reclamation activities. Surface rehabilitation, regrading and revegetation at Noranda's Brunswick No. 6 property (Figure 3: 18h) has been completed. A number of environmental issues related to the Caribou mine's (Figure 3: 18a) operating permits and reclamation requirements were reviewed in conjunction with the Standing Committee on Mining and Environment. At the Murray Brook mine site (Figure 3: 18d), as part of ongoing reclamation, the copper ore on the leach pad was removed and placed in the open pit, the leach pad buried, and some surface infrastructure removed. Remedial action of a breach in the tailings dam at ADEX's Mount Pleasant mine (Figure 3: 18e) during spring flooding included construction of a lowered granular spillway—the upstream tailings deposit was not affected by the breach. Gordex Minerals Limited's Cape Spencer property (Figure 3: 18i) and APOCAN's Lake George antimony property (figure 3: 18j) remained inactive during 1998.

Most mining companies have maintained their reclamation on disturbed land in accordance with their approved schedule. Reclamation and remediation progress is on-going at several properties. Preparations for final closure of some properties are coming to the review stage. Instances of non-compliance are dealt with according to regulation.

QUARRIABLE SUBSTANCES ADMINISTRATION Quarriable substances on Crown lands in New Brunswick are administered under the *Quarriable Substances Act*. The Quarriable Substances Administrator prepares and issues permits and leases for removal of aggregate material from Crown lands. Paul O'Leary retired from this position in June 1998 and was succeeded by Mitchell O'Donnell.

Major extraction activity (more than 10 000 t) occurred at Blue Mountain in the Bathurst area (Figure 3: 22a), Shaddeck Lake in the Miramichi area (Figure 3: 22b), Hanwell and Sears roads in the Fredericton area (Figure 3: 22c), and St. Martins area of southern New Brunswick (Figure 3: 22d).

The preliminary value of quarriable substances extracted from pits and quarries located on Crown land amounted to $487 568.10. The total number of permits issued was 280. One new quarry lease was issued in 1998, bringing the total number of quarry leases to 15and the total area held by quarry leases to 629.62 ha (Table 3).

The Crown land quarry inventory program that was started in 1995 was continued in 1998. To date, 236 quarry sites have been inventoried, with the collected information being put into a Microsoft Access database program. As well, site locations are being plotted onto base maps.

COMMITTEES John Griggs is a member of the Federal–Provincial Committee on Mineral Statistics, which coordinates the efforts of Natural Resources Canada and the provincial governments in the timely collection of relevant mineral statistics while minimizing the inconvenience to the respondent. In October, he represented the province at the annual meeting of this committee in Ottawa. Sam McEwan, John Griggs, and Cory Neumann, the reclamation engineer, are members of the interdepartmental Standing Committee on Mining and the Environment, which was established in 1989. The committee meets regularly during the year to address issues dealing with mining and the environment. Sam McEwan and John Griggs are members of the Science and Technology Intergovernmental Working Group. This is a national committee consisting of provincial and federal representatives, which provide input to the federal government regarding their research and development programs on mining technology. In October, Sam McEwan attended the Science and Technology Intergovernmental Working Group meeting in Devon, Alberta. Sam and John are also members of the Interdepartmental Committee on Mineral Resources, a provincial committee with representatives from the departments of Economic Development, Tourism and Culture; Environment; and Natural Resources and Energy. This committee addresses mining issues common to all three departments.

Sam McEwan heads a committee charged with the development of a new Pits and Quarries Policy for the province. Also, with the participation of John Griggs, he chairs a committee to draft a new provincial blasting code. Sam is also a member of the Intergovernmental Task Force on Offshore Mining, which is seeking a means of developing an Offshore Minerals Management Regime.

CONFERENCES/WORKSHOPS/COURSES In September 1998, John Griggs and Sam McEwan attended the 28th Annual Convention of the New Brunswick Branch of the Canadian Institute of Mining, Metallurgy and Petroleum in Bathurst, New Brunswick. Sam McEwan attended the CIM Annual General Meeting in Montréal during May of 1998 and the Mines and Mineral Revenue Assessors Meeting in St. John's, Newfoundland in June. This conference provides a forum for Mine Assessors and those dealing with mining tax legislation to compare systems, problems and technologies related to this subject. Mr. McEwan also attended the Intergovernmental Working Group on Mining, Minerals and Metals Science and Technology in Edmonton, Alberta in October. This meeting affords the opportunity to provide CANMET with direction on research into mining related technologies, which are of mutual interest to all provinces within Canada.

Energy Management

The Energy Management Section is responsible for energy infrastructure and market development and regulation. Energy efficiency and air emissions reduction are promoted through policies, programs and regulation. Energy supply and demand and commodity price statistics are compiled and analysed for policy development and public information. As the work is not directly related to resource development, further details are not presented in this report. The Section is managed on an interim basis by Darwin Curtis.

GEOSCIENTIFIC EDITORIAL SERVICES

The Geoscience Editor for Minerals and Energy Division publications, Barbara M.W. Carroll, reports to the Director of the Department's Communications Branch. She is responsible for editing geoscience maps and editing and formatting geoscience reports submitted by Division staff for publication as Mineral Resource Reports or Information Circulars. The third category, Open File, is published as received. A system of scientific/technical review has been put into place that ensures that peers review manuscripts before they are submitted for publication. Annually prepared publications include: "Preliminary Review of New Brunswick's Mineral Industry," "Rétrospective préliminaire de l'industrie au Nouveau-Brunswick," "New Brunswick's Mineral Industry," "Current Research," and "Abstracts/Résumés." In 1998, 28 reports and 138 maps were edited and/or prepared for publication.

In September 1998, Barbara Carroll attended the 28th Annual Convention of the New Brunswick Branch of the Canadian Institute of Mining, Metallurgy and Petroleum in Bathurst, New Brunswick. She also attended the annual Review of Activities of the New Brunswick Minerals and Energy Division held in Fredericton in November.

MINE TAXATION

Reporting to the Director of Financial Services, the Mine Assessor, Tanis A. Taylor, is responsible for the collection of all revenue due the province from mineral taxation and royalties.

The Mine Assessor is responsible for the administration of various Acts as they relate to the collection of taxes and royalties due the province, and is required to provide estimates for Central Government regarding the amount of revenue expected from each source. The Acts involved are: *Metallic Minerals Tax Act*, *Mining Act*, *Quarriable Substances Act*, and *Oil and Natural Gas Act*. Taxes and royalties collected in 1998–99 amounted to $11 317 933. The metal mines subject to the *Metallic Minerals Tax Act* are required to make monthly payments, based on an estimate of the amount of taxes owing, and submit an annual tax return within six months of their year end. These annual returns are audited and assessment notices are issued. On-site audits as well as desk audits are conducted on companies subject to the *Metallic Minerals Tax Act* to determine compliance with the Act. On-site audits are also conducted on producers of other commodities to determine compliance with the appropriate acts.

Royalties are collected as follows: Monthly—coal, natural gas; Quarterly—potash, salt, oil; Semi-annually—peat moss, sand and gravel.

Provincial Mine Assessors and Mineral Revenue Assessors hold an annual conference in order to discuss matters of mutual concern associated with mineral taxation and collection.

MINING COMMISSIONER'S REPORT

Mr. Michael P. Quinn [Suite 301, 500 Beaverbrook Court, Fredericton, New Brunswick, E3B 5X4; Telephone (506) 450-0980; Fax (506) 450-7824] was appointed Mining Commissioner effective July 1, 1996. No disputes were heard by the Mining Commissioner in 1998.

Minerals and Energy Division Publications

Reports

Arthur, K. 1998. Chevron Canada Resources Ltd. and Irving Oil Limited report on 1984 gravity survey for the Moncton Basin, New Brunswick (parts of NTS 21 H/14, 15, 16 and 21 I/1, 2, 3). New Brunswick Department of Natural Resources and Energy, Minerals and Energy Division, Open File 98-12, digital text file.

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Bérubé, D. and Thibault, J.J. 1998. Coastal zone geomorphology of the Northumberland Strait, southeast New Brunswick. New Brunswick Department of Natural Resources and Energy, Minerals and Energy Division, Geoscience Report 96-2, 86 p.

Carroll, B.M.W. (editor) 1998. Preliminary review of New Brunswick's mineral industry, 1997. New Brunswick Department of Natural Resources and Energy, Minerals and Energy Division, Mineral Resource Report 98-1, 27 p.

Carroll, B.M.W. (rédactrice) 1998. Rétrospective préliminaire de l'industrie minérale au Nouveau-Brunswick, 1997. Ministère des Ressources naturelles et de l'Énergie du Nouveau-Brunswick, Division des ressources minières et de l'énergie, Rapport sur les ressources minérales 98-2, 29 p.

Carroll, B.M.W. (editor) 1998. New Brunswick's mineral industry, 1997. New Brunswick Department of Natural Resources and Energy, Minerals and Energy Division, Mineral Resource Report 98-3, 123 p.

Carroll, B.M.W. (editor) 1998. Current Research 1997. New Brunswick Department of Natural Resources and Energy, Minerals and Energy Division, Mineral Resource Report 98-4, 152 p.

This report contains the following papers:

S.C. Johnson, M.J. McLeod A note on the potential for paleoplacer gold in the Memramcook and Sackville areas and the relationship to Upper Carboniferous stratigraphy.

R.F. Miller, S.C. Purdy Lower Carboniferous Tealliocaris woodwardi (Crustacea: Malacostraca), from the Macumber Formation, New Brunswick (NTS 21 H/5).

M.A. Parkhill, A.G. Pronk, P.W.B. Friske A multimedia geochemical survey in the vicinity of copper skarn occurrences in the McKenzie Gulch area (parts of NTS 21 O/10, 11, and 15), northern New Brunswick.

A.A. Seaman Till geochemistry of the west half of the Millville (NTS 21 J/3) map area, York and Carleton counties, New Brunswick.

R.A. Wilson Geology of the Roger Brook area (parts of NTS 21 O/08a, b, g, h), Bathurst Mining Camp, New Brunswick.

Carroll, B.M.W. (editor/rédactrice) 1998. Abstracts, 1998: 23rd annual Review of Activities / Résumés, 1998 : 23e rétrospective annuelle des activités. New Brunswick Department of Natural Resources and Energy, Minerals and Energy Division / Ministère des Ressources naturelles et de l'Énergie du Nouveau Brunswick, Division des ressources minières et de l'énergie, Information Circular 98-3, 62 p.

East West Caribou Mining Limited. 1998. Restigouche Mine, New Brunswick—Development of innovative environmental planning and treatment technologies. New Brunswick Department of Natural Resources and Energy, Minerals and Energy Division, Open File 98-3, 522 p.

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FEENEY, G.M. 1998. Chevron Canada Resources Ltd. and Irving Oil Limited report on 1982 gravity survey for New Brunswick (NTS 21 H/14, 15, 16; 21 I/1, 2, 3; parts of 21 H/9, 10, 11, 12, 13, 16 and 21 I/1, 4, 5, 6, 7). New Brunswick Department of Natural Resources and Energy, Minerals and Energy Division, Open File 98-9, digital text file.

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KOOIMAN, G.J.A. 1996 (revisions 1998). St. Stephen nickel deposit, Charlotte County, New Brunswick—A compilation. New Brunswick Department of Natural Resources and Energy, Minerals and Energy Division, Open File 96-19, 39 p.

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Plates (See List of Publications for detailed listings)

MP 98-1A–H to 98-4A–H (32 plates)
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MP 98-5A–B to 98-15A–H (22 plates)
Multiparameter airborne geophysical survey, central Restigouche County, New Brunswick (NTS 21 O/10, 11, 15, 16) – colour interval maps. New Brunswick Department of Natural Resources and Energy and Geological Survey of Canada. Scale: 1:50 000.

MP 98-16 (1 plate)
Geology of the Kingston Peninsula (parts of NTS 21 G/08, 09; 21 H/05, 12). S. Barr and C.E. White. Scale: 1:50 000.

MP 98-17 (1 plate)
Selected engineering data: bedrock/granular aggregate samples from the Fredericton, Grand Lake, Minto, and Burtts Corner map areas (NTS 21 H/15, 16; 21 J/1, 2), New Brunswick. T.C. Webb and L.G. Johnson. Scale: 1:250 000.

MP 98-18 (6 plates)
Bedrock geology of the Mount Pleasant area (21 G/7f, g; 21 G/10a–c, e) and geologic sections of the Mount Pleasant Caldera complex. (1990 thesis maps). S.R. McCutcheon. Scale: 1:20 000.

MP 98-19A–C (3 plates)
Au, Ag, As, Hg, Sb; Cu, Zn, Pb, Co, Ni; Mn, Fe, Sn, W, Th, U in tills of the western half of the Millville (NTS 21 J/03) map area. A.A. Seaman. Scale: 1:50 000.

MP 98-20 (1 plate)
Selected limestone and dolomite deposits of New Brunswick. T.C. Webb. Scale: 1:500 000.

MP 98-21A–D (4 plates)
(A) Major mineral, (B) industrial mineral, (C) peat producers; (D) significant mineral deposits in New Brunswick. T. Leonard. Page-size maps.

MP 98-22 to 98-34 (13 plates)
Bedrock geological compilation maps (NTS 21 G). M. McLeod and S.C. Johnson (all plates); L.R. Fyffe (98-25, 98-28); A.A. Ruitenberg (98-27). Scale: 1:50 000.

MP 98-35 to 98-39 (5 plates)
Cu, Ag, Mo, Pb, and Zn contents of stream-sediment samples, NTS 21 O/11 and parts of 21 O/10, 14, 15, 16, Restigouche County. A.G. Pronk and P.W.B. Friske. Scale: 1:50 000.

MP 98-40 (1 plate)
Geology of central Restigouche County (NTS 21 O/10, 11, 14, 15, 16W). K. Giggie. Scale: 1:100 000

MP 98-41A–B to 98-45A–B (10 plates)
(A) Au, Ag, As, Sb, Hg; (B) Cu, Pb, Zn, Ni, Co content of stream-sediment samples, NTS 21 G/11, 12, 13, 14, 15. A.G. Pronk, P.R. Boldon. Scale: 1:50 000.

MP 98-46 to 98-50 (5 plates)
Au, As, and Sb content of stream-sediment samples, NTS 21 O/11 and parts of 21 O/10, 14, 15, 16, Restigouche County. A.G. Pronk and P.W.B. Friske. Scale: 1:50 000.

MP 98-51 (1 plate)
Bedrock geological compilation of the Grand Manan Island area (NTS 21 B/10). M.J. McLeod, P. Stringer, S.C. Johnson. Scale: 1:50 000.

MP 98-52 (1 plate)
Bedrock geological compilation of the Campobello Island area (NTS 21 B/15 and part of 21 B/14). M.J. McLeod, S.C. Johnson, P. Stringer. Scale: 1:50 000.

MP 98-53 to 98-60B (13 plates)
BP Exploration Canada Limited seismic lines, Millstream, 1982. Lines BP-81-115 to BP-81-122. NTS 21 H/12).

MP 98-61 (1 plate)
Millstream, 1981 final plan. NTS 21 H/12. BP Exploration Canada Limited.

MP 98-62 to 98-67 (6 plates)
Synthetic seismogram, Well nos. 1 to 6, Millstream, New Brunswick. NTS 21 H/12.

MP 98-68 (1 plate)
Millstream, 1981 final plan. NTS 21 H/12. BP Exploration Canada Limited.

MP 98-69 (1 plate)
Well index map, Stoney Creek oil and gas field, Albert County, New Brunswick (part of NTS 21 H/15W). C. St. Peter. Scale: 1:7500.

MP 98-70 (1 plate)
Geology of the Jake Lee Mountain area (NTS 21 G/02g), New Brunswick. L.R.Fyffe. Scale: 1:20 000.

MP 98-72 (1 plate)
New Brunswick standard oil and natural gas grid map. Scale: 1:500 000.

MP 98-73A (1 plate)
Province of New Brunswick bituminous shale rights, Hillsborough–Memramcook area (NTS 21 H/15, parts of 21 H/10, 16, 21 I/1, 2). R. Phillips. Scale: 1:220 000.

MP 98-74A (1 plate)
Province of New Brunswick underground storage rights, Hillsborough–Memramcook area (NTS 21 H/15, parts of 21 H/10, 16, 21 I/1, 2). R. Phillips. Scale: 1:220 000.

MP 98-75 (1 plate)
Province of New Brunswick oil and natural gas rights. Scale: 1:150 000.

Conference Papers and Posters Presented by Division Staff

BARR, S.M., WHITE, C.E., and MCLEOD, M.J. 1998. Comagmatic volcanic and granitoid rocks of the Kingston belt, southern New Brunswick—a Silurian volcanic arc? (abstract). Paper presented at the Colloquium and Annual General Meeting of the Atlantic Geoscience Society, Wolfville, Nova Scotia, February 6–7, 1998. *In* Atlantic Geology, **34**: 58.

CARROLL, B.M.W. (editor / rédactrice) 1998. Abstracts, 1998: 23rd annual Review of Activities / Résumés, 1998: 23e Rétrospective annuelle des activités. New Brunswick Department of Natural Resources and Energy, Minerals and Energy Division / Ministère des Ressources naturelles et de l'Énergie du Nouveau-Brunswick, Division des ressources minières et de l'énergie, Information Circular 98-3, 62 p. This volume contains the following:

S.M. Barr, J. Price, O.Gaskill Petrology of the St. Stephen gabbroic pluton and associated sulphides / Pétrologie du pluton gabbroïque de St. Stephen et sulfures associés.

S.M. Barr, C.E. White Field relations, petrology, and structure of Neoproterozoic rocks of the Caledonian Highlands, southern New Brunswick / Rapports sur les lieux, pétrologie et structure des roches Néo-Protérozoïques des collines calédoniennes, Sud du Nouveau-Brunswick.

S.M. Barr, C.E. White Metavolcanic and granitoid rocks and amphibolitic dykes of the southwestern Kingston belt, southern New Brunswick / Roches métavolcaniques et granitiques et dykes amphibolitiques du sud-ouest de la ceinture de Kingston, Sud du Nouveau-Brunswick.

D.R. Boyle Tin in massive sulphide deposits and associated gossans of the Bathurst Mining Camp: Exploration model and genetic implications / L'étain dans les gîtes de sulfures massifs et les chapeaux ferrugineux associés au Camp minier de Bathurst : modèle de prospection et répercussions génétiques.

F.W. Chandler, K.L. Buchan Redbed copper deposits of the Canadian Maritimes: Recent thoughts on genetic models / Gîtes cuprifères des formations rouges des Maritimes : réflexions récentes sur les modèles génétiques.

J.W. Davis Devil Pike gold discovery, Kings County, New Brunswick (part of NTS 21 H/12) / Découverte d'or de Devil Pike, comté de Kings, Nouveau-Brunswick (partie de SNRC 21 H/12).

M.L. Dickson, M.A. Parkhill Quaternary geology and glacial dispersal in the area of the Popelogan skarn occurrences, northern New Brunswick / Géologie du Quaternaire et dispersion glaciaire dans le secteur des venues de skarns de Popelogan, Nord du Nouveau-Brunswick.

J.M. Franklin, M.D. Hannington, I.R. Jonasson Establishing exploration criteria for volcanogenic massive sulphide deposits: New concepts, old ideas, unanswered problems.

P.W.B. Friske, M.W. McCurdy, S.J.A. Day National geochemical reconnaissance in New Brunswick / Le programme d'exploration géochimique préliminaire au Nouveau-Brunswick.

L.R. Fyffe Bedrock geology and mineral potential of the Jake Lee Mountain map area (NTS 21 G/2g), southwestern New Brunswick / Géologie du substrat rocheux et potentiel minéral du secteur cartographique du mont Jake Lee (SNRC 21 G/2g), Sud-Ouest du Nouveau-Brunswick.

K.V. Giggie, R.B.K. Shives Ground follow-up to Restigouche multisensor airborne geophysical survey: Results and interpretation / Suivi au sol du relevé géophysique aérien à multicapteurs de Restigouche : résultats et interprétation.

W.D. Goodfellow Geology, geochemistry and genesis of the Caribou massive sulphide deposit, Bathurst Mining Camp, northern New Brunswick / Conformation géologique et géochimique et genèse du gîte de sulfures massifs Caribou, Camp minier de Bathurst, Nord du Nouveau-Brunswick.

S.C. Johnson Bedrock geology of the Nerepis–Seven Mile Lake area, southern New Brunswick / Géologie du substrat rocheux du secteur de Nerepis–lac Seven Mile, Sud du Nouveau-Brunswick.

P.B. Keating, J. Katsube, F.G. Kiss Geological significance of electromagnetic signatures defined by a high-resolution airborne survey, Bathurst Mining Camp / Signification géologique des signatures électromagnétiques obtenues lors du levé haute résolution du Camp minier de Bathurst.

F. Kiss Airborne electromagnetic, magnetic, gamma-ray spectrometer survey in the Restigouche area, northwestern New Brunswick / Levé spectrométrique gamma, magnétique et électromagnétique dans le secteur de Restigouche, Nord-Ouest du Nouveau-Brunswick.

J.P. Langton, P.G. Banks, R. van de Poll The EXTECH-II CD-ROM: a Caris-based system for accessing exploration and assessment data from the Bathurst Mining Camp, northern New Brunswick.

D.R. Lentz, J.A. Walker, S.R. McCutcheon Pyroclastic volcanism and volcanogenic massive sulphide deposit genesis: Resolving the depth dilemma / Genèse des gîtes de sulfures massifs d'origine volcanique et volcanisme pyroclastique : résolution du dilemme au sujet de la profondeur.

M. Leybourne, W. Goodfellow, D. Boyle Improved methods of hydrogeochemical exploration in the Bathurst Mining Camp / Méthodes améliorées d'exploration hydrogéochimique du Camp minier de Bathurst.

S.H. McClenaghan, D.R. Lentz, W. Goodfellow Petrological, geochemical, and isotopic characteristics of selected massive sulphide deposits in the Bathurst Mining Camp: A preliminary report / Caractéristiques pétrologiques, géochimiques et isotopiques de certains gîtes de sulfures massifs du Camp minier de Bathurst : rapport préliminaire.

K.J. McLaughlin, D.R. Lentz Petrological and geochemical attributes of the Benjamin River porphyry Cu deposit, northeastern New Brunswick / Attributs pétrologiques et géochimiques du gîte de cuivre porphyrique de la rivière Benjamin, Nord-Est du Nouveau-Brunswick.

S. Merlini, M. McLeod, J. Walker New Brunswick mineral occurrence database / Base de données informatisée des gisements minéraux du Nouveau-Brunswick.

M.A. Parkhill, A. Doiron, T. Pronk, M.L. Dickson Quaternary geology maps of the Bathurst Mining Camp, northern New Brunswick / Carte géologiques du Quaternaire du Camp minier de Bathurst, Nord du Nouveau-Brunswick.

J.M. Peter, W.D. Goodfellow Genetic and spatial relationships between massive sulphides and iron formations of the Bathurst Mining Camp / Relations génétiques et spatiales entre les sulfures massifs et les formations ferrifères du Camp minier de Bathurst.

N. Rogers, C.R. van Staal Petrochemistry of volcanic rocks of the Bathurst Mining Camp / Pétrochimie des roches volcaniques du Camp minier de Bathurst.

A.A. Seaman Follow-up till geochemistry and surficial geology studies in the Millville map area (NTS 21 J/3), west-central New Brunswick / Étude géochimique du till et étude géologique des formations superficielles de suivi dans le secteur cartographique de Millville (SNRC 21 J/3), centre-ouest du Nouveau-Brunswick.

M.D. Thomas, J.A. Walker, P. Keating, R. Shives, S.R. McCutcheon, G. Boustead, F. Kiss, W.D. Goodfellow Geophysical atlas of the Bathurst Mining Camp, New Brunswick / Atlas géophysique du Camp minier de Bathurst, Nouveau-Brunswick.

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R.A. Wilson, C.R. van Staal, S.R. McCutcheon, L.R. Fyffe Revised stratigraphic nomenclature for the Bathurst Mining Camp, northern New Brunswick / Révision de la nomenclature stratigraphique du Camp minier de Bathurst, Nord du Nouveau-Brunswick.

LENTZ, D.R. and VAN STAAL, C.R. 1998. Mass-balance constraints on solution transfer fabric development in the footwall felsic volcanic rocks of the Brunswick No. 6 massive-sulfide deposit, Bathurst Camp, New Brunswick: effects of deformation-induced mass transfer on host rock compositions (abstract). Poster presented at the Colloquium and Annual General Meeting of the Atlantic Geoscience Society, Wolfville, Nova Scotia, February 6–7, 1998. *In* Atlantic Geology, **34**: 68–69.

PARKHILL, M.A. and DOIRON, A. 1998. Drift prospecting in the vicinity of the Restigouche deposit, Bathurst Mining Camp (abstract). Poster presented at the Colloquium and Annual General Meeting of the Atlantic Geoscience Society, Wolfville, Nova Scotia, February 6–7, 1998. *In* Atlantic Geology, **34**: 72.

External Publications

LYNCH, G., GILES, P.S., DEBLONDE, C., BARR, S.M., PIPER, S.W.J., ST. PETER, C., HÉTU, R.J., JOHNSON, S.C., PE-PIPER, G., ST-JEAN, R., MURPHY, J.B., CHANDLER, F.W., AND BOEHNER, R.C. 1998. Magdalen Basin NATMAP—Onshore Geological Database. Geological Survey of Canada, Open File D3564. [CD-ROM]

ST. PETER, C., JOHNSON, S.C., DEBLONDE, C., and LYNCH, G. 1997. Geological compilation, west central Nova Scotia, southeastern New Brunswick and western Prince Edward Island. Geological Survey of Canada, Open File 3521. [coloured map]

FYFFE, L.R. 1997. Discussion: Upper Lower Cambrian depositional sequence in Avalonian New Brunswick. Canadian Journal of Earth Sciences, **33**: 229.

LENTZ, D.R. 1998. Petrochemical evolution of felsic volcanic sequences associated with Phanerozoic volcanic-hosted massive sulphide systems: the role of extensional geodynamics. Ore Geology Reviews, **12**: 289–327.

CHAPTER 2.
MINERAL EXPLORATION IN NEW BRUNSWICK

METALLIC MINERALS

Northern New Brunswick

The annual informal telephone poll, taken in October, indicates that exploration expenditures in the northern half of the Province for 1998 are approximately $10 300 000, down about $1 200 000 from 1997. However, this number is equivalent to or greater than the exploration expenditure in each of the years from 1991 to 1995. Notably, the decline for 1998 is not as great as the drop predicted by Natural Resources Canada (NRCan) last June in its release of 1996–1998 exploration expenditures. Bear in mind that northern New Brunswick generally accounts for about 90% of New Brunswick's total expenditure. For example, the preliminary figure for northern New Brunswick was $10 300 000, whereas NRCan's preliminary figure for the whole province was $12 200 000. Statistics from the database of the Province's Recorder indicates that the number of new claims recorded in northern New Brunswick during 1998 was 1338 and the number of claims in effect on December 31 was 14 230.

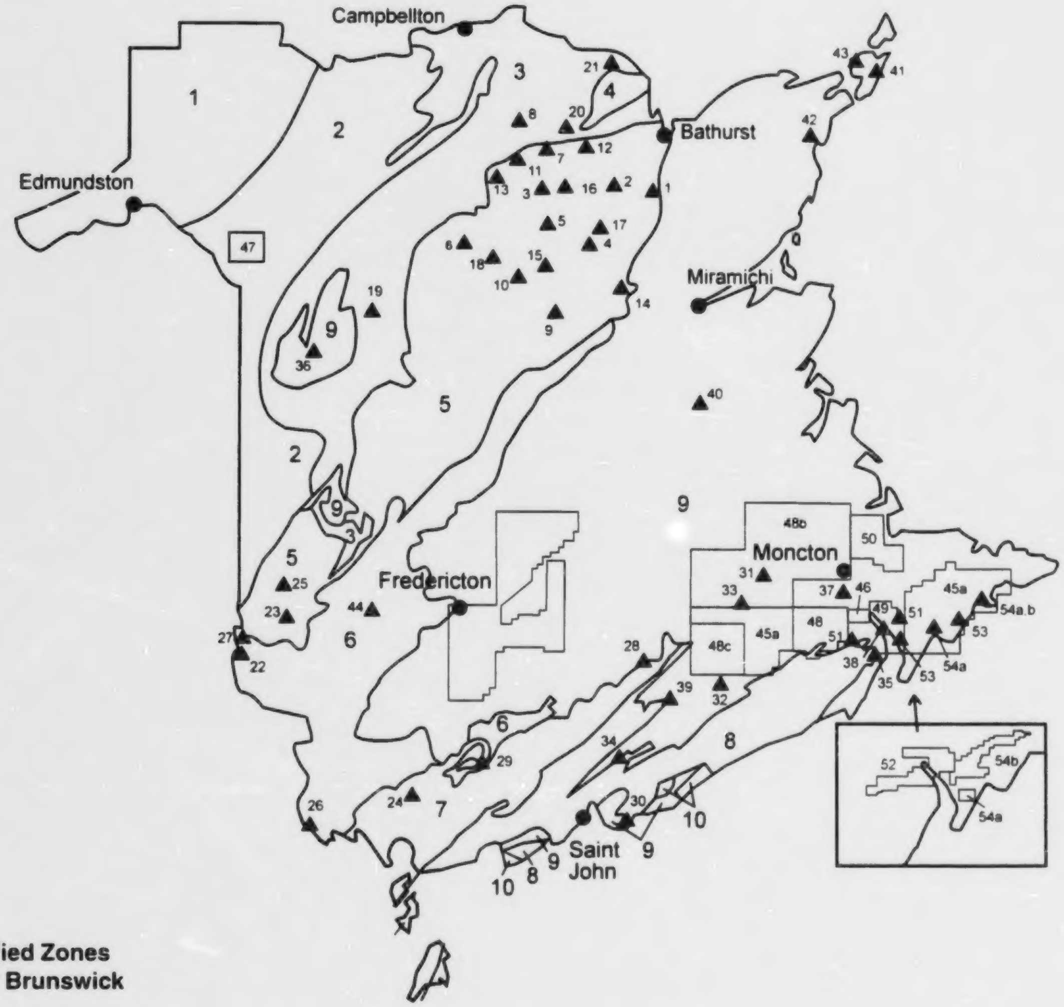
As usual, most of the exploration activity in northern New Brunswick was focused on base metals in the Bathurst Mining Camp. The active major companies were Breakwater Resources Ltd., Noranda Inc. and Teck Exploration Ltd., which collectively spent about $6 100 000. The active junior mining companies were Black Bull Resources Inc., Chapleau Resources Limited, Cimarron Minerals Limited, Eastmain Resources Inc., Fancamp Resources Ltd., Major General Resources Limited, Mountain Lake Resources Inc., Northeast Exploration Services Limited, NovaGold Resources Inc., Slam Exploration Ltd., and Stratabound Minerals Corp., which collectively spent aproximately $3 600 000. All but two of these companies, Chapleau and NovaGold, received funding under the New Brunswick Exploration Assistance Program (NBEAP) for junior mining firms.

Noranda Inc. accounted for a large proportion of exploration expenditures in northern New Brunswick. In 1998, Noranda spent approximately $4 880 000 within the Bathurst Mining Camp, down $1 240 000 from 1998 and $2 790 000 from the year before. Keep in mind that Noranda (including Brunswick) has spent, on average, about $6 000 000 annually on exploration throughout this decade. From east to west, Noranda's land holdings are concentrated in six belts: Key Anacon–Lawson Brook belt, Brunswick–Portage River belt, Wedge–Indian Lake belt, Heath Steele–Mountain Brook belt, Halfmile Lake–TV Tower belt and Kagoot Brook belt (Figure 6: 1–6). Notably, Noranda has dropped or will be dropping a large number of claims this year but has added 116 claims to the Key Anacon–Lawson Brook belt. Noranda also has a small block of claims in the Orvan Brook area (Figure 6: 7).

In the Key Anacon–Lawson Brook belt (Figure 6: 1), Noranda drilled six holes, totalling about 4878 m, to test subtle magnetic targets beneath Carboniferous cover rocks. Three of these holes cut a stringer zone, over 400 m long, of chloritic footwall alteration containing pyrrhotite–pyrite and minor chalcopyrite. "Significant sphalerite and galena" were noted in two of the holes. In the Brunswick–Portage River belt (Figure 6: 2), nine deep holes totalling about 9300 m were drilled in proximity to the No.12 mine but did not encounter any significant mineralization; three holes, comprising 1625 m, were drilled on the Gilmour South property. One of these holes cut a fault zone containing a 25-cm-block or knocker

Legend

1. Claims, Key Anacon–Lawson Brook belt (Noranda Mining and Exploration Inc./Noranda Inc.)
2. Claims, Brunswick–Portage River belt (Noranda Mining and Exploration Inc./Noranda Inc.), Railroad (Eastmain Resources Inc.)
3. Claims, Wedge–Indian Lake belt (Noranda Mining and Exploration Inc./Noranda Inc.), California Lake North (Homestake Canada Inc.), California Lake (NovaGold Resources Inc.; Black Bull Resources Inc.)
4. Claims, Heath Steele–Mountain Brook belt (Noranda Mining and Exploration Inc./Noranda Inc.), Little River (Teck Exploration Ltd.)
5. Claims, Halfmile Lake–TV Tower belt (Noranda Mining and Exploration Inc./Noranda Inc.), Mount Fronsac (Noranda Mining and Exploration Inc.), Goodwin Lake (Mountain Lake Resources Inc.)
6. Claims, Kagoot Brook belt (Noranda Mining and Exploration Inc./Noranda Inc.)
7. Mining Lease 246, Caribou mine (CanZinco Ltd.)
   Claims, Orvan Brook (Noranda Mining and Exploration Inc.), South Tetagouche (Teck Exploration Ltd.), Caribou–McMaster belt (CanZinco Ltd.), Camel Back (Eastmain Resources Inc.), Fossil Hill (Log House Construction Ltd.)
8. Claims, Devils Elbow (Noranda Mining and Exploration Inc.)
9. Claims, Chester (Teck Exploration Ltd.), Chester Northeast (Black Bull Resources Inc.)
10. Claims, Kenny Lake area (Teck Exploration Ltd.)
11. Mining Lease 252, Murray Brook mine (NovaGold Resources Inc.)
    Claims, Murray Brook North and West (Teck Corporation), Camel Back Ext. (Black Bull Resources Inc.), Tower (Northeast Exploration Services Ltd.)
12. Claims, Armstrong–Middle River belt (CanZinco Ltd.), Middle River (Northeast Exploration Services Ltd.)
13. Mining Lease 255, Restigouche mine (CanZinco Ltd.)
14. Claims, Tingley Brook (Eastmain Resources Inc.)
15. Claims, Holmes Meadow (Eastmain Resources Inc.), Clearwater Lake (Slam Exploration Ltd.)
16. Claims, Rocky Lake and Otter Brook (Eastmain Resources Inc.)
17. Claims, Nepisiguit Brook (Major General Resources Ltd.), Nepisiguit Brook and Tomogonops River (Stratabound Minerals Corp.)
18. Claims, Portage (Northeast Exploration Services Ltd.)
19. Claims, Harrison Ridge (Slam Exploration Ltd.), Shingle Gulch (Chapleau Resources Limited)
20. Claims, Clarinda (Slam Exploration Ltd.)
21. Claims, Turgeon Deposit (Heron Mines Limited)
22. Claims, Browns Mountain/Browns Lake (Fancamp Resources Ltd.)
23. Claims, Eel River (Pat Marr)
24. Claims, Digdeguash (Peter Fenety)
25. Claims, Connell Brook (Noranda Mining and Exploration Inc.)
26. Claims, St. Stephen nickel deposit (Cobrun Mining Corporation)
27. Claims, Golden Ridge (Freewest Resources Canada Inc.)
28. Claims, Annidale (PGE Resource Corp.)
29. Claims, Otter Lake (Reg Cox)
30. Claims, Armstrong Brook (Pro-Max Resources Inc.)
31. Claims, Buckley Road (Goldcorp Inc.)
32. Claims, Glebe Mine (Maritime Resource Research Limited)
33. Claims, Hicksville (Goldcorp Inc.), Springhill (Lafarge Canada Inc.), Glenvale (Lafarge Canada Inc.)
34. Claims, Bonney Road (J.D. Irving Limited)
35. Claims, Hillsborough (Ken Whaley), Demoiselle (Ken Whaley)
36. Claims, Day and Airstrip (Daniel F. Merrithew)
37. Claims, Lower Coverdale (Noranda Inc.)
38. Claims, Petitcodiac River (Avard Hudgins)
39. Millstream potash deposit
40. Peat exploration licence (Premier Horticulture ltée)
41. Peat exploration licence (La Mousse Acadienne (1979) ltée)
42. Peat lease (Jiffy Products (N.B.) Ltd.)
43. Peat exploration licence (La Tourbe de Petite-Lamèque)
44. Peat exploration licence (Les Tourbières M.L. Ltée)
45. Oil and natural gas licence to search (Corridor Resources Inc.)
46. Oil and natural gas lease (Irving Oil Limited)
47. Oil and natural gas licence to search (Jean Mariadassou)
48. Oil and natural gas licence to search (MariCo Oil and Gas Corporation)
49. Oil and natural gas licence to search (J.A. Seglund Inc.)
50. Oil and natural gas licence to search (RHT Enterprises Ltd.)
51. Bituminous shale development permits (A.A. (NB) Inc.)
52. Bituminous shale licence to search (Shell Canada Limited)
53. Underground storage exploration licences (St. Clair Pipelines (1996) Ltd.)
54. Underground storage exploration licences (Intragaz)



Simplified Zones of New Brunswick

1. Edmundston
2. Kedgwick
3. Tobique-Chaleur
4. Elmtree
5. Miramichi
6. Fredericton
7. Passamaquoddy
8. Saint John
9. Maritimes Basin
10. Fundy Basin

Figure 6. Some exploration properties in New Brunswick, 1998.

of Brunswick-type massive sulphide that graded 18% Zn and 11% Pb. Locating the source of this knocker will be a high priority in the future. In the Wedge–Indian Lake belt (Figure 6: 3), ten holes totalling 2600 m have been drilled since late last year to test targets in the vicinity of the Camel Back Showing. Iron formation and chloritic alteration containing low-grade sulphides have been intersected but no new massive sulphide zones have been found. In the Heath Steele–Mountain Brook belt (Figure 6: 4), a gravity survey was conducted in the Mountain Brook area and a 2-D seismic line was shot at Heath Steele. In the Halfmile Lake–TV Tower belt (Figure 6: 5), 3-D seismic work was carried out at Halfmile Lake and trenching and drilling were done on the Mount Fronsac and Devils Elbow properties (Figure 6: 5, 8) that Noranda acquired since late last year.

Teck Exploration Ltd. has properties in the Little River, South Tetagouche, Chester, Kenny Lake, and Murray Brook areas (Figure 6: 4, 7, 9–11) but only conducted exploration on the South Tetagouche property, which is referred to as the North Rim property. Teck became the sole owner of this 338-claim property since last year, which had been held under a 50:50 joint venture with Inmet Mining Corporation. A number of new targets were identified from a gravity survey carried out during the summer and five holes, totalling 2200 m, were drilled in the fall. No results were reported by year's end. In the fall, Teck staked 30 claims in the vicinity of California Lake (Figure 6: 3).

Breakwater Resources Ltd. and its wholly owned subsidiary, CanZinco Ltd., conducted extensive exploration (approximately $800 000) in two areas this season, namely, the Caribou–McMaster belt and the Armstrong–Middle River belt (Figure 6: 7, 12). Another 45.1 km of grid lines were cut (240 km last year), on which 41.0 km induced polarization, 6.1 km Max-Min, and 24.2 km magnetometer–VLF surveys were completed. Since the latter part of 1997, fifteen holes totalling 4563 m were drilled, eight in the Armstrong–Middle River belt and seven in the Caribou–McMaster belt. A new massive sulphide zone was discovered on the Caribou mine lease, 2.2 km east of the mine site (Figure 6: 7). The best assay came from a 12.8 m sulphide intersection that contains 0.7 m grading 12.7% Zn.

The Caribou mine and Restigouche open pit (Figure 6: 7, 13) have been shut down since September because of historically low metal prices and lower than expected Zn recoveries. The feasibility study for Caribou predicted an 83% Zn recovery and a 70% Pb recovery. At the time of closure, the Pb recovery was more-or-less on target but Zn recovery was about 18% lower than predicted in the study and 10% lower than the mine's revised 75% target.

In 1998, NovaGold Resources Inc. was the biggest spender among the junior companies, with an expenditure of $850 000, not including funds provided by the New Brunswick Exploration Assistance Program. Early in the year, NovaGold drilled one hole on its California Lake property (Figure 6: 3) to test an anomaly with coincident geophysical and geochemical signatures but encountered no massive sulphides. However, most of the company's effort was focused on its Murray Brook deposit (Figure 6: 11) where 14 holes were completed and a UTEM survey was conducted. The object of the drilling was to test the down-plunge extent of the known Cu zone in the open pit and to determine if the deposit also has a significant Pb–Zn zone. Modelling of the previous vertical drill holes, using a commercially available 3-D software package, showed that the deposit was virtually untested toward the northwest, in the F_2 down-plunge direction. The best reported Cu intersection was in hole MB-98-3, which contained 13.6 m grading 4.35% Cu, including 7.0 m grading 7.29% Cu. The best reported lead–zinc intersection was in hole MB-98-5A, which contained 20.2 m grading 2.08% Pb, 6.07% Zn and 73.66 g/t Ag.

Eastmain Resources Inc. finalized its deal with BHP Minerals Canada Ltd. in late December of 1997, which gave Eastmain the rights to all of BHP's claims in, and their database for, the Bathurst Mining Camp (Railroad, Camel Back, Tingley Brook and Holmes Meadow; Figure 6: 2, 7, 14, 15). Eastmain spent approximately $450 000 in 1998, giving it the second highest expenditures after NovaGold. Early in the year Eastmain focused on drill targets on its previously held Rocky Lake–Otter Brook property (Figure 6: 16), on which it has a joint venture with McBroom Resources. Three holes, totalling about 600 m, were drilled near Nepisiguit River, another three totalling 550 m near Half Moon Lake, and two more totalling about 400 m between Grants Lake and Caribou Lake (Figure 6: 16). Two brand new prospects were found as a result of this drilling. The prospect west of Half Moon Lake appears to be the strike continuation of the Taylor Brook horizon and is within a 30–50 m thick, intensely chloritic, fine-grained tuff or siltstone. One hole that cut this tuff contained 12 m grading more than 2% Zn. The other new prospect is within Moody Brook fragmental rocks (hanging wall at Halfmile Lake) and consists of disseminated sulphides, up to 130 m thick, which are geochemically anomalous in Zn (4000 ppm).

Eastmain also conducted initial exploration on its Railroad and Camel Back properties (Figure 6: 2, 7). Trenching at Camel Back showed that previously delineated conductors were caused by graphitic sedimentary rocks. Two grids, totalling more than 80 line kilometres, were cut on the Railroad property; detailed mapping, ground geophysics (induced polarization and magnetometer surveys) and trenching have been carried out to delineate stratigraphy and identify potential drill targets. Previous drilling (six holes in 1996) by BHP in the southern part of this property resulted in the discovery of a new prospect. Hole RR-96-04 cut 8 m of massive sulphide grading 4.5% Zn, 2.2% Pb, 0.3% Cu and 49.2 g/t Ag.

Major General Resources Ltd. spent about $350 000 on its Nepisiguit Brook property (Figure 6: 17) since the fall of 1997. Exploration during this time has consisted of magnetometer/VLF (136 line kilometres), gradient induced polarization (41 km), and deep-section induced polarization (11.3 km) surveys, and five drill holes totalling 3339 m. The last one was completed in the fall of 1998. A press release in February announced that hole NB-97-23 had encountered two zones: an upper 15.5 m interval of semi-massive (20–40%) sulphides grading 1.44% Zn, 0.7% Pb and 8.57 g/t Ag, and a lower zone of base-metal-enriched, chlorite–magnetite iron formation grading 0.24% Zn, 0.18% Pb and 4.34 g/t Ag over 4 m. The last hole, NB-98-25, was collared 550 m south of hole NB-97-23 and drilled to test the same zones along strike. Assays are pending.

During the winter, Stratabound Minerals Corp. drilled 24 holes, totalling 2960 m, on its Nepisiguit Brook and Tomogonops River groups (Figure 6: 17). Several narrow sulphide zones were discovered on the Nepisiguit Brook claim group, including one (0.5 m) in hole 15, which is considered to be equivalent to the "Brunswick Horizon" and another (0.75 m) in hole 19, which is considered to be equivalent to the "Heath Steele Horizon." An additional 23 claims were added to the Tomogonops River Group to cover possible extensions to magnetic and alteration trends. During the summer, the existing grid was extended to include these new claims so that geophysical surveys (magnetometer and VLF) and mapping could be carried out.

In 1997, Mountain Lake Resources Inc. signed a joint venture deal with Noranda Inc. (as operator) on its Goodwin Lake Cu–Ni property (Figure 6: 5). During the winter and spring, Mountain Lake spent about $300 000 to enable Noranda to conduct a seven-hole, 2700 m drilling program to test the continuity of the zinc discovery found in hole 97-2, which intersected 6.6 m of massive sulphides grading 8.2% Zn, 0.2% Pb, 0.1% Cu and 15.1 g/t Ag. No results were released from this drill program.

In 1997, Black Bull Resources optioned several claim blocks from Northeast Exploration Services Limited; this year, the company optioned Teck's claims near Chester (Figure 6: 9) and a block along Highway 180 (Figure 1: 7) from Log House Construction Ltd. (Rufus Smith). Black Bull also staked another 45 claims in three separate areas: California Lake, Chester and Camel Back (Figure 6: 3, 9, 11). A gravity survey was conducted at the Chester deposit utilizing NBEAP funding. Trenching was conducted on the Log House option and preliminary exploration was done on some of the company's other properties, including Camel Back and County Line, Resources, GIS and Little Sevogle.

During the summer, Northeast Exploration Services Ltd. added 60 claims to its Portage Brook property (Figure 6: 18) and worked the Tower and Middle River properties (Figure 6: 11, 12). The Tower property was formerly optioned to Connecticut Development Corporation, which had drilled three holes in the southern part of the property in 1996. The best intersection was in hole CDC96-1, which contained a 5 m interval grading 2.32% combined Pb+Zn. In 1998, additional linecutting and geophysical surveys were carried out on the property to identify other drill targets. On the Middle River property, which was previously held by Granges Inc. for its gold potential, the old grid was refurbished, ground geophysical surveys were carried out and one drill hole was completed in the fall. Assays are pending.

Slam Exploration Ltd. and its partners spent about $300 000 in total on its properties, only one of which, Clearwater Lake (Figure 6: 15), is in the Bathurst Mining Camp. Soils were collected on this property. Most of Slam's work was focused on its Harrison Ridge and Clarinda properties, in the Costigan Mountain and Tetagouche Lakes areas, respectively (Figure 6: 19, 20). Four holes totalling about 1100 m were drilled on the Harrison Ridge base metal property in the Lower Devonian Tobique Group and more than 2 km of trenching were completed on the Clarinda gold property in the Silurian Chaleurs Group.

Fancamp Resources Ltd. entered a joint venture agreement with Heron Mines Limited on the Turgeon Cu–Zn property near Belledune (Figure 6: 21). A new grid was cut, geophysical surveys (deep-section induced polarization and magnetometer) and a limited amount of trenching have been completed. Fancamp also recently staked 212 claims in western New Brunswick, southwest of Woodstock (Figure 6: 22).

In the late fall and early winter, Chapleau Resources Limited conducted further drilling on its Shingle Gulch property (Figure 6: 19). Another eight holes (SB-97-51 to SB-97-58) totalling approximately 2000 m were drilled. The best intersection reported was in Hole SB-97-57, which cut 5.4 m of 1.4% Cu. No further work was done 1998.

Southern New Brunswick During 1998, exploration continued for various metallic mineral commodities including base-metal sulphides, nickel–cobalt–copper and gold. Exploration was also very active for industrial minerals and energy-related resources. The Provincial Recorder's database indicates that the number of claims recorded in 1998 was 1164 and the number of claims in effect at year's end was 3611.

For base-metal sulphides, a Lower Ordovician, calc-alkaline volcanic sequence is being assessed for volcanogenic massive sulphide deposits by Phelps Dodge Corporation of Canada Ltd. in the Eel River area (Figure 6: 23). Potential for these deposits was demonstrated in previous drilling by BHP Minerals Canada Ltd.

Peter Fenety and others continued work on stratiform zinc–copper mineralization near St. George

(Figure 6: 24), which occurs primarily in mafic flows of the Lower Devonian Digdeguash Formation. They have demonstrated that the mineralized horizon and mineralized rocks above and below the main horizon extend at least 700 m along strike, and that there may also be associated gold.

After completing geophysical and geochemical surveys, Noranda Inc. conducted a drilling program to investigate an Ordovician copper–gold porphyry system near Woodstock (Figure 6: 25). Pat Marr has also discovered extensive, low-grade copper mineralization in the Miramich Group in this area, possibly emanating from a similar, previously unrecognized porphyry copper system.

Cobrun Mining Corporation staked additional claims on its St. Stephen Ni–Co–Cu deposit (Figure 6: 26) that is related to a Devonian, mafic–ultramafic intrusion. The company completed a three-hole drilling program and was successful in extending one of the main mineralized zones (the Roger's Farm Zone) to the south and at depth. They also redrilled the E Zone, which is immediately east of the Roger's Farm Zone, and intersected about 10 m of good-grade, massive mineralization.

Several companies remained interested in exploring the Carboniferous fluviatile rocks of southeastern New Brunswick for sediment-hosted base-metal sulphide deposits and gold, but active exploration in these rocks is limited at present.

Exploration for gold in southern New Brunswick continued to be active especially in the Canterbury area west of Fredericton, where the work of Freewest Resources Canada Inc. has generated a significant staking rush. Last year, numerous high-grade gold occurrences (several grams per tonne) were discovered on the company's Golden Ridge property (Figure 6: 27). Geological interpretation of this property is in its infancy, but preliminary work has demonstrated that gold is associated with a large (kilometer-scale), intensely altered felsic to intermediate volcanic complex of possible Ordovician age. The highest-grade mineralized zones appear to occur along faults and shears associated with the Woodstock Fault, which is one of the major terrane-bounding structures in this region. Following-up on these observations, on airborne and ground geophysical surveys, and on geochemical anomalies, an extensive stripping and detailed sampling program has been initiated.

Other companies that hold large claim groups in the area include Maple Mark International Inc., Black Bull Resources Ltd., Noront Resources Ltd., Fancamp Resources Ltd. and Sparton Resources Inc. Most of this ground was staked to follow-up geochemical anomalies and/or to cover other major terrane-scale faults in the region. Preliminary results from some of these companies are encouraging.

Several other gold properties received attention this year including those in Ordovician rocks in the Annidale, New River and Rollingdam areas, and one in Cambrian/Neoproterozoic rocks in the Cape Spencer area. PGE Resource Corp. successfully continued to discover numerous, new, high-grade gold occurrences in the Annidale area (Figure 6: 28) north of the fault-related Devil Pike Brook gold deposit and along strike to the southwest in a similar structural package at New River.

Reginald Cox has found a previously unrecognized and potentially very significant style of mineralization (contact metasomatic?) in the Rollingdam area (Figure 6: 29) in metasedimentary rocks along the contact granitoid rocks of the Saint George Batholith. Preliminary work has revealed an extensive mineralized zone that yields samples with high-grade gold (more than 34 g/t) associated, in part, with massive antimony mineralization.

Pro-Max Resources Inc. conducted extensive prospecting on its Armstrong Brook Property (Figure 6: 30) along strike of the Cape Spencer gold deposit south of Saint John. They have relocated an old, high-grade gold showing related to thrust fault zones that host gold throughout the area. Numerous other gold showings were also found in quartz/carbonate vein systems in the vicinity of the old showing.

Technical Progress Reports

The following Technical Progress Reports were received in 1998:

Report No.	Company	Property	NTS	Release Date
PR10-101	Bruce Taylor	Evandale	21 G/09E	1/07/2000
PR10-102	CanZinco Ltd.	McMaster	21 O/09W	1/07/2000
PR10-103	CanZinco Ltd.	Woodside Brook	21 O/09W	6/16/2000
PR10-104	Fosters Resources Ltd.	Devil Pike	21 H/12W	6/17/2000
PR10-105	Noranda Mining & Exploration Inc.	Narrows	21 P/05W	7/16/2000
PR10-106	Noranda Inc.	Little Bald Mtn.	21 O/08W	7/16/2000
PR10-107	Noranda Inc.	Moody Bk.	21 O/08W	8/21/2000
PR10-108	PGE Resource Corp.	Devils Lake	21 H/12W	9/20/2000
PR10-109	Stratabound Minerals Corp.	CNE West	21 P/05W	11/20/2000
PR10-110	Major General Resources Limited	Nepisiguit Brook	21 P/05W	8/272000
PR15-004	Noranda Inc.	Brunswick	21 P/05W	02/12/2000
PR15-005	Noranda Inc.	Satellite	21 O/01E	05/08/2000
PR15-006	Noranda Mining & Exploration Inc.	Stratmat	21 O/08E	05/08/2000
PR15-007	Ian Graham	Headway	21 P/05W	07/21/2000
PR15-008	NovaGold Resources Inc.	California Lake	21 O/08W	10/20/2000
PR15-009	Noranda Inc.	Halfmile Lake S/Central	21 O/08W	09/29/2000
PR15-010	Wilfred Hachey	O'Hearn	21 O/08E	12/11/2000
PR15-011	Chapleau Resources Limited	Shingle Gulch	21 O/03E	01/20/2001

Mineral Exploration Reports of Work

During 1998, 163 reports of work were received by the Recorder in accordance with the *Mining Act*, Chapter M-14.1, S.N.B. 1985. These reports are summarized in tabular form on the following pages and their locations are shown on Figure 7. The name of the company or individual listed for each report of work is that of the holder of the mineral rights. Reports are arranged in the following order: (1) by the geological belt in which the claims are located, (2) alphabetically by company or individual, and (3) alphabetically by property name.

Claim Group	Geoscan No.	No. of Claims	NTS	Release Date	Description of Work
EDMUNDSTON ZONE					
41. Noranda Inc.					
a. Rivière Verte	475019	306	21 N/08E	Feb. 4, 2000	Grid establishment; trenching; geological mapping; magnetometer, induced polarization, and horizontal-loop EM surveys; collection and analysis of core samples; diamond drilling.

Claim Group	Geoscan No.	No. of Claims	NTS	Release Date	Description of Work
KEDGWICK ZONE					
21. Fahey, Joseph					
St. Leonard	475099	20	21 O/04W	Aug. 6, 2000	Milling experimentation.
33. Lagacy, R.					
a. Legacy deposit	475110	2	21 O/10W	Sept. 4, 2000	Compilation.
TOBIQUE–CHALEUR ZONE					
5. Baxter, R.G.					
a. Baldwin Lake	475052	12	21 O/03E	Apr. 3, 2000	Collection and analysis of silt and soil samples.
b. Lower Blue Mountain	475049	100	21 O/03E	Mar. 31, 2000	Collection and analysis of soil samples.
8. Black, Joey					
a. Gold Tetagouche	475159	24	21 O/09E	Oct. 19, 2000	Prospecting; collection and analysis of soil and rock samples.
b. Tetagouche	475130	10	21 O/09E	Nov. 6, 2000	General prospecting; collection and analysis of soil and rock samples.
14. Carroll, Wayne					
a. South Benjamin	475134	3	21 O/16W	Nov. 10, 2000	Grid establishment; collection and analysis of soil samples; re-analysis of previously drilled core samples.
17. Dimmell, Peter					
Mitchell	475092	12	21 P/13W	July 13, 2000	Geological mapping and compilation.
18. Drivas, Tom					
Harrison Ridge	475149	73	21 J/14E	Nov. 25,2000	General prospecting; geological mapping, deep-section geophysical survey; collection and analysis of soil samples.
20. Elmtree Resources Ltd.					
Sormany	475104	7	21 O/09E	Aug. 26, 2000	Grid establishment; geological mapping; trenching; collection and analysis of lithogeochemical samples.
23. Freewest Resources Canada Inc.					
a. Lombard Brook	475152	50	21 J/14E	Oct. 27, 2000	Trenching and pitting; diamond drilling.
26. Golden Bay Resources					
a. Tetagouche Lake	475176	24	21 O/09E	Jan. 20, 2001	Grid establishment; general prospecting; VLF and magnetometer survey.
35. Log House Construction Ltd.					
a. Big Pit	475175	20	21 O/10E	Jan. 13, 2001	General prospecting; trenching; collection and analysis of rock and soil samples.
b. Malachite	475160	43	21 O/10E	Dec. 10, 2000	General prospecting; trenching.

Reports of Work

1. Atcan Capital Corp.
2. Aube, Gilbert
3. Bathurst Exploration Ltd.
4. Bathurst Silver Mines Ltd.
5. Baxter, R.G.
6. Bires, David
7. Black Bull Resources Inc.
8. Black, Joey
9. Black, Yolande
10. Brancote Canada Ltd.
11. Buraglia, Roger
12. CanZinco Ltd.
13. CanZinco Ltd./Bathurst Silver Mines Ltd./W. Carroll
14. Carroll, Wayne
15. Carter, William
16. Cobrun Mining Corporation
17. Dimmell, Peter
18. Drivas, Tom
19. Eastmain Resources Inc.
20. Elmtree Resources Ltd.
21. Fahey, Joseph
22. Fenety, Peter
23. Freewest Resources Canada Inc.
24. Gammon Lake Resources Inc.
25. Goldcorp Inc.
26. Golden Bay Resources
27. Graham, Donald
28. Graham, Ian
29. J.D. Irving Limited
30. Johnston, Delbert
31. Key Anacon Mines Ltd.
32. Lafarge Canada Inc.
33. Lagacy, Raoul
34. Lavigne, Allan
35. Log House Construction Ltd.
36. Major General Resources Ltd.
37. Marr, Patrick
38. Mountain Lake Resources Inc.
39. Murray Brook Resources Inc.
40. Noel, Lorenzo
41. Noranda Inc.
42 Noranda Mining and Exploration Inc.
43. Northeast Exploration Services Ltd.
44. NovaGold Resources Inc.
45. O'Neil, J.
46. Pathfinder Resources Ltd.
47. Pro-Max Resources Inc.
48. Robichaud, Fernand
49. Ross, Frank
50. Roy, Alphe
51. Scott, Mitchell
52. Slam Exploration Ltd.
53. Stewart, Milton
54. Stewart, R.V.
55. Stratabound Minerals Corp.
56. Taylor, Michael
57. Teck Exploration Ltd.
58. Teck Exploration Ltd./Teck Corporation
59. Troup, William
60. Whaley, Ken
61. Willett, Connie

Simplified Zones of New Brunswick:

1. Edmundston
2. Kedgwick
3. Tobique–Chaleur
4. Elmtree
5. Miramichi
6. Fredericton
7. Passamaquoddy
8. Saint John
9. Maritimes Basin
10. Fundy Basin

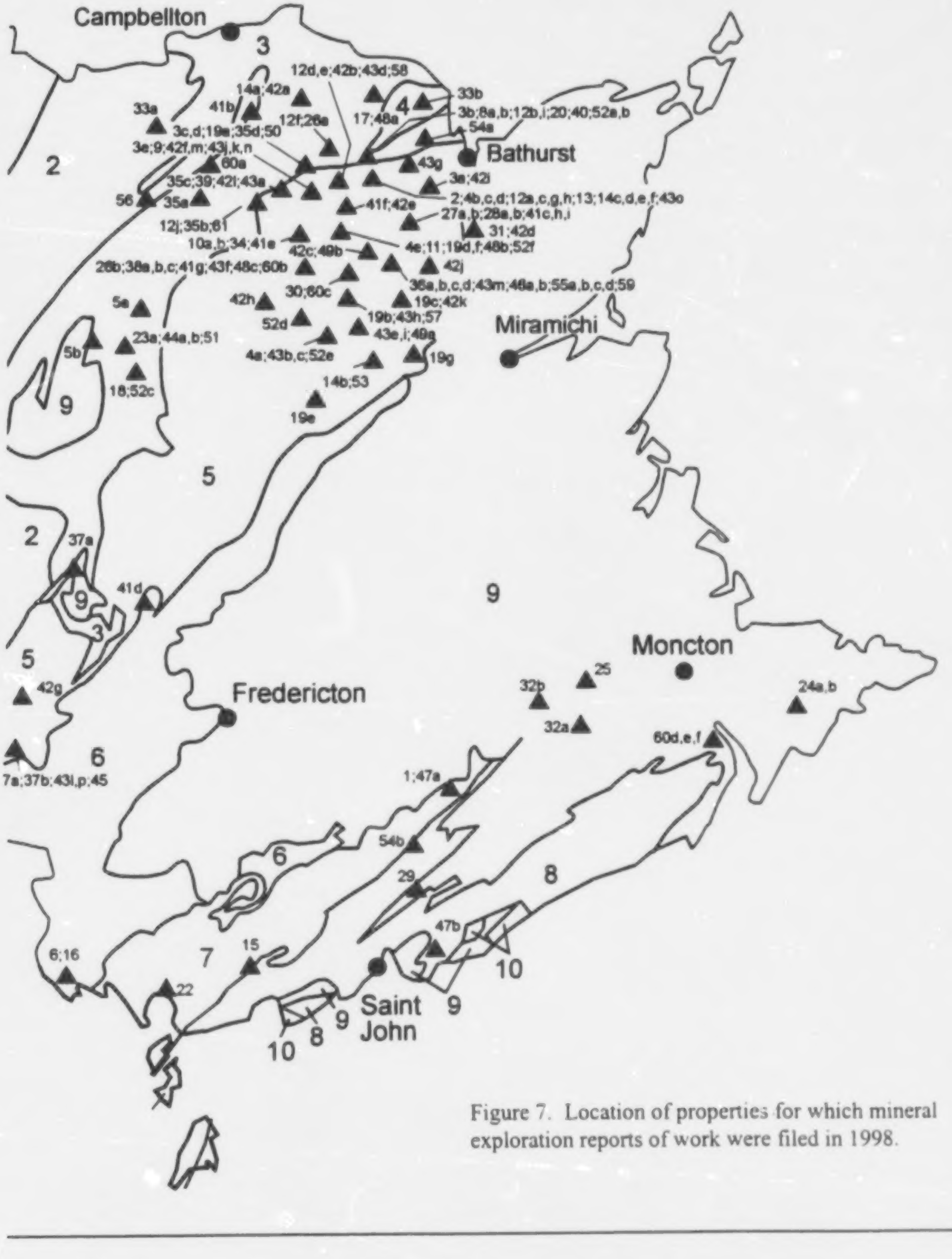


Figure 7. Location of properties for which mineral exploration reports of work were filed in 1998.

Claim Group	Geoscan No.	No. of Claims	NTS	Release Date	Description of Work
37. Marr, Patrick					
a. Waterville	475065	2	21 J/03W	May 4, 2000	Grid establishment; prospecting; geological mapping; collection and analysis of grab samples; magnetometer and VLF surveys; soil geochemistry survey.
40. Noel, Lorenzo					
Gold	475128	xx	21 O/09E	Nov. 3, 2000	General prospecting; collection and analysis of 36 soil samples.
41. Noranda Inc.					
b. Popelogan Lake	475179	106	21 O/15E	Jan. 28, 2001	Collection of drill core samples; drilling.
42. Noranda Mining and Exploration Inc.					
a. Connors Brook	475136	106	21 O/16W	Nov. 20, 2000	Grid establishment; collection and analysis of soil samples.
44. NovaGold Resources Inc.					
a. Jenkins Brook Lake	475027	65	21 O/03E	Jan. 29, 2000	Collection and analysis of soil samples.
b. Sewell Brook	475168	182	21 O/03E	Dec. 14, 2000	Drilling.
46. Pathfinder Resources Ltd.					
a. Nepisiguit	475181	25	21 P/05W	Feb. 4, 2001	Collection and analysis of soil samples.
48. Robichaud, Fernand					
a. Big Hole Brook	475177	4	21 O/16E	Jan. 22, 2001	General prospecting; collection and analysis of rock samples.
51. Scott, Mitchell					
Blue Mountain Lake	475050	13	21 O/03E	Apr. 1, 2000	Collection and analysis of soil samples.
52. Slam Exploration Ltd.					
a. Clarinda	475114	42	21 O/09E	Sept. 10, 2000	Grid establishment; trenching; collection and analysis of soil samples; geological mapping; VLF surveys.
b. Clarinda	475167	42	21 O/09E	Dec. 22, 2000	Grid establishment (linecutting, flagging); general prospecting; trenching; mapping; VLF electromagnetic, magnetic and induced polarization surveys; collection and analysis of rock and soil samples.
c. Harrison Ridge	475153	36	21 J/14E	Oct. 27, 2000	Diamond drilling.
54. Stewart, R.V.					
a. Beresford Cu	475091	8	21 P/12W	July 21, 2000	Geologic mapping; collection and analysis of rock samples.
56. Taylor, Michael					
Costigan	475097	232	21 J/14E	May 31, 2000	Diamond drilling.

Claim Group	Geoscan No.	No. of Claims	NTS	Release Date	Description of Work
60. Whaley, Ken					
a. Upsalquitch Forks	475046	64	21 O/10E	Mar. 31, 2000	Grid establishment; trenching; geological mapping; VLF, magnetometer, induced polarization surveys; collection and analysis of soil, rock and stream samples.
ELMTREE ZONE					
33. Lagacy, Raoul					
b. Elmtree Brook	475043	9	21 P/13W	Mar. 20, 2000	Grid establishment; prospecting; magnetometer; and VLF surveys.
MIRAMICHI ZONE					
2. Aube, Gilbert					
North Resources	475062	15	21 O/09E	Apr. 7, 2000	Prospecting; collection and analysis of rock and soil samples; and hand trenching.
3. Bathurst Exploration Ltd.					
a. 6 Mile Brook	475158	9	21 P/12W	Dec. 7, 2000	General prospecting; VLF electromagnetic and magnetic surveys; collection and analysis of soil and rock samples.
b. Arleau Brook	475122	20	21 O/09E	Oct. 13, 2000	
c. Gamble	475081	12	21 O/09W	June 8, 2000	Grid establishment; prospecting; VLF and magnetometer surveys.
d. Gamble	475086	12	21 O/09W	July 10, 2000	Grid establishment; prospecting; VLF and magnetometer surveys; collection and analysis of rock samples.
e. Peters Brook	475030	18	21 O/09W	Feb. 20, 2000	Prospecting; VLF and magnetometer surveys; collection and assay of rock samples
4. Bathurst Silver Mines Ltd.					
a. Chester	475094	2	21 O/01E	June 10, 2000	Compilation.
b. Middle River	475133	19	21 O/09E	Nov. 10, 2000	Ground induced polarization/resistivity survey.
c. Middle River South Ext.	475132	21	21 O/09E	Nov. 10, 2000	Ground induced polarization/resistivity survey; diamond drilling.
d. Resources	475093	75	21 O/09E	June 10, 2000	Compilation.
e. Resources	475119	75	21 O/09E	Oct. 1, 2000	Grid establishment; general prospecting; ground magnetic and VLF survey.
7. Black Bull Resources Inc.					
a. Browns Mtn.	475141	30	21 G/13E	Nov. 19, 2000	Prospecting; collection and analysis of grab, composite grab, and stream-sediment samples.

Claim Group	Geoscan No.	No. of Claims	NTS	Release Date	Description of Work
b. Monument	475142	35	21 G/13W	Nov. 19, 2000	Prospecting; collection and analysis of grab, composite grab and stream-sediment samples.
9. Black, Yolande					
Ginseng	475123	21	21 O/08E	June 28, 2000	Prospecting; collection and analysis of rock and soil samples.
10. Brancote Canada Ltd.					
a. Devils Elbow	475022	68	21 O/08W	Feb. 12, 2000	Grid establishment; geological mapping; magnetometer and VLF surveys; collection and analysis of soil and lithogeochemical samples.
b. Mount Fronsac	475021	31	21 O/08W	Feb. 12, 2000	Grid establishment; geological mapping; diamond drilling; collection and analysis of lithogeochemical samples.
11. Buraglia, Roger					
Bowser Lake	475129	9	21 O/08E	Nov. 13, 2000	General prospecting; ground magnetic and VLF electromagnetic survey; collection and analysis of soil and rock samples.
12. CanZinco Ltd.					
a. Armstrong	475079	44	21 O/09E	June 3, 2000	Diamond drilling.
b. Armstrong	475117	44	21 O/09E	Sept. 29, 2000	Induced polarization survey; collection and analysis of soil samples.
c. Armstrong	475155	54	21 O/09E	Dec. 9, 2000	Diamond drilling.
d. Caribou North	475107	12	21 O/09W	Sept. 3, 2000	Grid establishment; collection and analysis of soil samples.
e. McMaster	475071	24	21 O/09W	May 6, 2000	Collection and analysis of soil samples; and induced polarization survey.
f. McMaster	475109	15	21 O/09W	Sept. 2, 2000	Diamond drilling.
g. Middle River North	475131	9	21 O/09E	Nov. 10, 2000	Ground induced polarization/resistivity survey.
h. Middle River Wildcat	475125	16	21 O/09E	Oct. 30, 2000	Grid establishment; ground induced polarization/resistivity and magnetic/VLF surveys; collection and analysis of sediment samples.
i. Orvan Brook	475108	17	21 O/09E	Sept. 3, 2000	Induced polarization survey; compilation.
j. Restigouche Project	475116	43	21 O/10E	Sept. 29, 2000	Grid establishment; induced polarization survey; compilation.
13. CanZinco Ltd./Bathurst Silver Mines Ltd./Wayne Carroll					
Middle River	475070	88	21 O/09E	May 6, 2000	Collection and analysis of soil and stream samples.

Claim Group	Geoscan No.	No. of Claims	NTS	Release Date	Description of Work
14. Carroll, Wayne					
b. Little Sevogle–Northeast	475055	24	21 J/16E	Mar. 26, 2000	Grid establishment; geological mapping; Max-Min survey; collection and analysis of soil samples.
c. Middle River	475126	35	21 O/09E	Oct. 30, 2000	Grid establishment; ground induced polarization/resistivity and VLF/magnetic surveys; collection and analysis of sediment samples.
d. Roller	475127	50	21 O/09E	Oct. 30, 2000	Ground induced polarization/resistivity and VLF/magnetic surveys.
e. Roller	475164	50	21 O/09E	Dec. 14, 2000	Diamond drilling.
f. Roller/Middle River	475078	83	21 O/09E	June 3, 2000	Diamond drilling.
19. Eastmain Resources Inc.					
a. Camel Back	475145	43	21 O/09W	Nov. 19,2000	Trenching; geological mapping at trench sites; collection and analysis of rock samples.
b. Holmes Meadow	475120	66	21 O/01E	Oct. 1, 2000	General prospecting; collection and analysis of rock samples; compilation.
c. Little River Extension	475111	10	21 P/04W	Sept. 21, 2000	Compilation; collection and analysis of soil samples.
d. Otter Brook	475042	29	21 O/08E	Mar. 17, 2000	Grid establishment; geological mapping; magnetometer–VLF–Max-Min surveys; and collection and analysis of soil samples.
e. Porcupine	475112	10	21 J/16W	Sept. 21, 2000	Prospecting; collection and analysis of seep, soil, and silt samples; compilation; and drill core recovery.
f. Rocky Lake	475075	154	21 O/08E	June 1, 2000	Grid establishment; compilation; geological mapping; VLF, magnetometer, and Max-Min surveys.
g. Tingley Brook	475178	118	21 P/04W	Jan. 28, 2001	General prospecting; geological mapping; collection and analysis of rock samples.
23. Freewest Resources Canada Inc.					
b. Kirkland Lake	475172	90	21 G/13E	Jan. 8, 2001	Grid establishment; soil geochemistry survey.
26. Golden Bay Resources					
b. Maliseet Mountain	475151	11	21 O/08W	Dec. 1, 2000	Drill-hole pulse electromagnetic survey; collection of core and rock samples; diamond drilling.
27. Graham, Donald					
a. Headway North	475171	10	21 P/05W	Nov. 26, 2000	Gravity and elevation survey.
b. Headway West	475174	2	21 P/05W	Oct. 23, 2000	Grid establishment; induced polarization/resistivity survey.

Claim Group	Geoscan No.	No. of Claims	NTS	Release Date	Description of Work
28. Graham, Ian					
a. Headway	475139	15	21 P/05W	Nov. 24, 2000	Grid establishment; collection and analysis of till samples.
b. Headway	475173	15	21 P/05W	Oct. 26, 2000	Grid establishment; induced polarization/ resistivity and gravity survey.
30. Johnston, Delbert					
Delbert VI	475038	13	21 O/08E	Feb. 26, 2000	Prospecting; collection and analysis of soil samples.
31. Key Anancon Mines Ltd.					
Key Anacon Mine	475148	83	21 P/05E	Nov. 25, 2000	Collection and analysis of soil and water samples; site remediation.
34. Lavigne, Allan					
Camp 37	475156	4	21 O/08W	Dec. 9, 2000	General prospecting; trenching; collection and analysis of rock and soil samples.
35. Log House Construction Ltd.					
c. Camel Back	475040	25	21 O/09W	Mar. 4, 2000	Grid establishment; magnetometer; and VLF surveys.
d. Fossil Hill	475095	70	21 O/09W	July 7, 2000	Grid establishment; general prospecting; a number of small trenches; ground VLF and magnetometer survey; collection and analysis of rock and soil samples.
36. Major General Resources Ltd.					
a. Nepisiguit Brook	475034	127	21 P/05W	March 2, 2000	Grid establishment; HLEM–TDEM–induced polarization and magnetometer surveys.
b. Nepisiguit Brook	475135	176	21 P/05W	Nov. 9, 2000	Diamond drilling.
c. Nepisiguit Brook	475183	176	21 P/05W	Feb. 12, 2001	Gradient induced polarization survey.
d. Stewart Option	475035	9	21 P/05W	Mar. 2, 2000	Diamond drilling; collection and assay of core samples.
37. Marr, Pat					
b. Eel River	475166	59	21 G/13E	Dec. 21, 2000	Geological compilation; geological mapping; sampling and analysis of drill core; petrography.
38. Mountain Lake Resources Inc.					
a. Goodwin Extension	475084	22	21 O/08W	June 29, 2000	Compilation and geophysics.
b. Goodwin Extension	475085	18	21 O/08W	June 29, 2000	Compilation.
c. Goodwin Ext.	475161	22	21 O/08W	Oct. 2, 2000	Grid establishment; VLF/magnetic, Max-Min I and drill-hole pulse electromagnetic surveys; drilling; collection and analysis of soil and rock samples.

Claim Group	Geoscan No.	No. of Claims	NTS	Release Date	Description of Work
39. Murray Brook Resources Inc.					
North Kennco Licence	475082	24	21 O/09W	June 16, 2000	Grid establishment and UTEM survey.
41. Noranda Inc.					
c. Brunswick	475124	263	21 P/05W	Aug. 19, 2000	Grid establishment; trenching; collection and analysis of soil, rock, till and core samples; diamond drilling; horizontal-loop electromagnetic (EM), VLF, magnetometer, gravity, time-domain EM and pulse EM surveys.
d. Chainy Lake	475048	281	21 J/06E	Mar. 30, 2000	Diamond drilling.
e. Chiefs Plateau	475020	157	21 O/08W	Feb. 12, 2000	Diamond drilling; collection and assay of drill core samples; horizontal-loop EM survey.
f. Indian Lake	475087	178	21 O/08E	July 6, 2000	Grid establishment; magnetometer, VLF, horizontal-loop EM, gravity, time-domain EM surveys; collection and analysis of soil samples; diamond drilling; collection and assay of core samples.
g. Moody Brook/ Half Mile Lake area	475039	52	21 O/08W	March 6, 2000	Diamond drilling; collection and analysis of surface and core rock samples; trenching; seismic and down-hole pulse EM surveys.
h. Pabineau South	475073	47	21 P/05W	May 22, 2000	Trenching; geologic mapping; diamond drilling; down-hole pulse EM survey.
i. Sabina/Sabina Option	475140	159	21 P/05W	Nov. 18, 2000	Grid established at trench sites; geological mapping of trench sites; collection and analysis of rock samples; diamond drilling.
42. Noranda Mining and Exploration Inc.					
b. Beaver Lake	475059	25	21 O/09E	Aug. 9, 1998	General prospecting; collection and analysis of rock samples.
c. Bowser Lake	475138	19	21 O/08E	Nov. 20, 2000	Grid establishment; general prospecting; geological survey; collection and analysis of soil and rock samples.
d. Bruce Siding	475051	238	21 P/05E	Apr. 1, 2000	Grid establishment; magnetometer survey; and diamond drilling.
e. California Lake	475068	40	21 O/08E	Aug. 20, 2000	Prospecting; collection and analysis of rock samples.
f. Camel Back East	475064	173	21 O/9W	Mar. 30, 2000	Grid establishment; magnetometer, gravity, time-domain EM and Max-Min surveys; collection and analysis of soil samples.

Claim Group	Geoscan No.	No. of Claims	NTS	Release Date	Description of Work
g. Connell Bk.	475165	63	21 J/04E	Dec. 15, 2000	Grid establishment; geological mapping; soil geochemical survey; magnetometer and induced polarization (IP) surveys; diamond drilling; rock and drill core collection and analysis.
h. Kagout	475053	179	21 O/02E	Apr. 8, 2000	Grid establishment; horizontal-loop electromagnetic (EM) and magnetometer surveys; collection and analysis of soil samples.
i. Middle River	475090	30	21 P/12W	July 29, 2000	Prospecting.
j. Narrows	475150	445	21 P/05W	Nov. 12, 2000	Grid establishment; trenching; ground horizontal-loop electromagnetic and magnetic surveys; borehole pulse electromagnetic survey; collection and analysis of soil and rock samples; diamond drilling.
k. Tomogonops River	475137	19	21 P/04W	Nov. 20, 2000	Grid establishment; geological mapping; ground magnetic/VLF survey; collection and analysis of silt and rock samples.
l. Upsalquitch Lake	475077	78	21 O/08W	June 1, 2000	Grid establishment; horizontal-loop EM and magnetometer surveys.
m. 40 Mile Steady	475044	31	21 O/09E	Mar. 20, 2000	Grid establishment; geologic mapping; trenching, horizontal-loop EM and magnetometer surveys; and collection and analysis of soil samples.
43. Northeast Exploration Services Ltd.					
a. Camel Back	475118	9	21 O/09W	Oct. 1, 2000	Prospecting; compilation; VLF and magnetometer surveys.
b. Chester	475060	2	21 O/01E	Apr. 21, 2000	Geological mapping.
c. Chester	475080	2	21 O/01E	June 10, 2000	Compilation.
d. County Line	475015	11	21 O/09E	Feb. 2, 2000	Grid establishment and Max-Min survey.
e. GIS South	475057	39	21 O/01E	Mar. 26, 2000	Grid establishment; geologic mapping; IP, VLF, magnetometer and Max-Min surveys; collection and analysis of soil samples.
f. Goodwin	475121	36	21 O/08W	Oct. 2, 2000	Grid establishment; ground VLF/magnetic, Max-Min I and bore-hole pulse electromagnetic surveys; diamond drilling; collection and analysis of core and soil samples.
g. Middle River	475102	30	21 P/12W	Aug. 13, 2000	Grid establishment; VLF, magnetometer and Max-Min surveys; overburden drilling.

Claim Group	Geoscan No.	No. of Claims	NTS	Release Date	Description of Work
h. Sevogle/GIS	475054	6	21 O/01E	Mar. 26, 2000	Grid establishment; magnetometer, VLF and Max-Min surveys; collection and analysis of soil samples.
i. Sevogle East Extension	475058	10	21 O/01E	Mar. 26, 2000	Grid establishment; VLF, magnetometer and Max-Min surveys; collection and analysis of soil samples.
j. South 40 Mile Brook	475013	4	21 O/09W	Feb. 2, 2000	Grid establishment; geological mapping; Max-Min survey.
k. South 40 Mile Extension	475014	7	21 O/09E	Feb. 2, 2000	Grid establishment; geologic mapping.
l. Springfield	475143	70	21 G/13E	Nov. 19, 2000	Prospecting; collection and analysis of grab, composite grab and stream-sediment samples.
m. Tomogonops	475182	27	21 P/05W	Feb. 5, 1999	Geocompilation.
n. Tower North	475163	10	21 O/08W	Dec. 14, 2000	Grid establishment; VLF/magnetic (Omni) and horizontal-loop electromagnetic (Max-Min I) surveys.
o. Wildcat	475069	36	21 O/09E	May 6, 2000	Collection and analysis of soil and stream-sediment samples.
p. Whalen	475144	25	21 G/13E	Nov. 19, 2000	Prospecting; collection and analysis of grab, composite grab and stream-sediment samples.
45. O'Neil, J.					
Dead Creek	475169	4	21 G/13E	Jan. 4, 2001	Prospecting; collection and analysis of grab samples.
46. Pathfinder Resources Ltd.					
b. Nepisiguit	475028	57	21 P/05W	Feb. 12, 2000	Grid establishment; collection and analysis of soil samples; horizontal-loop EM survey.
48. Robichaud, Fernand					
b. Hillside	475154	10	21 O/08W	Oct. 13, 2000	General prospecting; Beep Mat electromagnetic survey; collection and analysis of rock samples.
c. Norwest	475157	43	21 O/08W	Dec. 7, 2000	General prospecting; Beep Mat 2 electromagnetic survey; collection and analysis of rock samples; plugger holes drilled.
49. Ross, Frank					
a. Goose	475047	1	21 O/01E	Mar. 28, 2000	Collection and analysis of soil samples; prospecting.
b. Ross/Lanteigne	475106	16	21 O/08E	Sept. 3, 2000	Grid establishment; prospecting; geological mapping; collection and analysis of soil samples.

Claim Group	Geoscan No.	No. of Claims	NTS	Release Date	Description of Work
50. Roy, Alphe					
Resources	475074	22	21 O/09E	May 29, 2000	Grid establishment; VLF and magnetometer surveys.
52. Slam Exploration Ltd.					
d. Clearwater Lake (2 Roads)	475024	4	21 O/01W	Sept. 18, 1999	Grid establishment.
e. Clearwater Lake	475063	73	21 O/01W	Apr. 23, 2000	Grid establishment; prospecting; geologic mapping; VLF and magnetometer surveys; collection and analysis of rock and soil samples.
f. South Wedge	475115	4	21 O/08E	Sept. 24, 2000	Grid establishment; geological mapping; VLF survey; collection and analysis of soil samples.
53. Stewart, Milton					
Little Sevogle–Stewart	475056	6	21 J/16E	Mar. 26, 2000	Grid establishment; Max-Min survey; collection and analysis of soil samples.
55. Stratabound Minerals Corp.					
a. Nepisiguit Brook/ Taylor Brook Extension	475096	42	21 P/05W	Aug. 5, 2000	Grid establishment; magnetometer, VLF, gravity surveys; collection and analysis of soil samples; diamond drilling.
b. Taylor Brook East Ext.	475100	58	21 P/05W	Aug. 6, 2000	Grid establishment; magnetometer, VLF, induced polarization (IP) surveys; collection and analysis of soil samples.
c. Tomogonops River	475037	119	21 P/05W	Mar. 3, 2000	Grid establishment; geological mapping; magnetometer, VLF, gravity, and EM-16 surveys; collection and analysis of soil samples; diamond drilling.
d. Tomogonops West	475045	21	21 O/08E	Mar. 23, 2000	Grid establishment; geologic mapping; collection and analysis of soil samples; magnetometer and VLF surveys.
57. Teck Exploration Ltd.					
Chester	475010	164	21 O/01E	Feb 2, 2000	Grid establishment; trenching; diamond drilling; collection and analysis of lithogeochemical samples; IP survey
58. Teck Exploration Ltd./Teck Corporation					
Bathurst North	475076	354	21 O/09E	May 25, 2000	Trenching; claim staking; geological mapping; diamond drilling; down-hole pulse and time-domain electromagnetic surveys; collection and analysis of lithogeochemical samples.
59. Troup, William					
Heath	475036	10	21 P/05W	Feb. 27, 2000	Grid establishment; VLF and magnetometer surveys; collection and analysis of soil samples

Claim Group	Geoscan No.	No. of Claims	NTS	Release Date	Description of Work
60. Whaley, Ken					
b. Nowlan Lake	475025	37	21 O/08W	Feb. 16, 2000	Grid establishment; collection and analysis of soil samples.
c. Otter Brook	475026	51	21 O/08E	Feb. 16, 2000	Grid establishment; collection and analysis of soil samples.
61. Willett, Connie					
Ransom Brook	475101	2	21 O/07E	Aug. 13, 2000	Prospecting; collection and analysis of rock samples.
FREDERICTON ZONE					
6. Bires, David					
Mohannes	475032	4	21 G 03W	Mar. 2, 2000	Prospecting; collection and analysis of grab samples.
16. Cobrun Mining Corporation					
St. Stephen Nickel	475061	37	21 G 03W	Apr. 23, 2000	Diamond drilling; collection and analysis of drill-core samples; petrography.
PASSAMAQUODDY ZONE					
1. Atcan Capital Corp.					
East Scotch Settlement	475162	22	21 H/13W	Dec. 14, 2000	Grid establishment; prospecting; collection and analysis of grab samples; soil geochemistry survey.
22. Fenety, Peter					
Digdeguash	475105	17	21 G/02W	Aug. 25, 2000	Prospecting; petrography; reconnaissance soil-sediment survey; magnetic and radiometric surveys.
47. Pro-Max Resources Inc.					
a. Annidale	475170	18	21 H/13W	Jan. 5, 2001	Prospecting; collection and analysis of grab samples; VLF survey.
54. Stewart, R.V.					
b. First Run	475041	33	21 H/12W	Mar. 16, 2000	Geological mapping; prospecting; collection and analysis of grab, soil, till and panned concentrate samples.
SAINT JOHN ZONE					
15. Carter, William					
New River	475103	4	21 G/02E	Aug. 25, 2000	Prospecting; orientation soil-sediment geochemistry survey.
29. J.D. Irving Limited					
Bonney Road	475098	12	21 H/05W	July 20, 2000	Air track-drilling program.
47. Pro-Max Resources Inc.					
b. Armstrong Brook	475072	25	21 H/04W	May 8, 2000	Prospecting; geological compilation; collection and analysis of grab samples.

Claim Group	Geoscan No.	No. of Claims	NTS	Release Date	Description of Work
MARITIMES BASIN					
24. Gammon Lake Resources Inc.					
a. Aboushagan	475066	25	21 H/16W	May 4, 2000	Grid establishment; prospecting; collection and analysis of grab samples; stream, soil, and till geochemistry surveys; diamond drilling.
b. Aboushagan	475113	22	21 I/01W	Sept. 10, 2000	Prospecting; stream, till and soil geochemistry surveys.
25. Goldcorp. Inc.					
Buckley Road	475067	8	21 I/03E	May 6, 2000	Grid establishment; air track- and diamond-drilling program; collection and analysis of drill powder and drill core samples.
32. Lafarge Canada Inc.					
a. Glenvale	475080	2	21 H/14E	June 9, 2000	Diamond drilling and analysis of drill core samples.
b. Springhill	475088	18	21 I/03W	July 16, 2000	Diamond drilling and analysis of drill core samples.
60. Whaley, Ken					
d. Demoiselle	475147	12	21 H/15E	Nov. 19, 2000	Grid establishment; diamond drilling and drill core analysis.
e. Demoiselle	475180	2	21 H/15E	Jan. 29, 2001	Bulk sampling and testing.
f. Hillsborough	475146	9	21 H/15E	Nov. 19, 2000	Grid establishment; diamond drilling and drill core analysis.

Deposits

Halfmile Lake Zinc, Lead, Copper, Silver

LOCATION The Halfmile Lake property (Figure 6: 5) is about 20 km west of the Heath Steele mine and 55 km, by road, from the Brunswick No. 12 mine (NTS 21 O/08W).

RIGHTS In 1998, the 73 mineral claims constituting the Halfmile Lake property were held by Noranda Inc. (Halfmile Lake South, 30 claims) and Noranda Mining and Exploration Inc. (Halfmile Lake North, 18 claims; Halfmile Lake Central, 25 claims) under the *Mining Act*, Chapter M-14.1, S.N.B. 1985.

The property consists of three massive sulphide deposits, Lower Halfmile Lake, Upper Halfmile Lake, and Halfmile North. The largest and highest grade is the Lower deposit, which consists of three separate zones. The Upper AB Zone, previously held by Kidd Creek Mines and Falconbridge Limited, lies within the Noranda Inc. portion of the property (Halfmile Lake South claim group); the Lower AB (Halfmile Lake Central) and Main (Halfmile Lake North) zones lie within the Noranda Mining and Exploration Inc. part of the deposit.

HISTORY (See Miscellaneous Report 19)

RESERVES Geological resource for the Lower AB Zone: 6 100 000 t grading 3.20% Pb, 9.70% Zn, 0.01% Cu and 43.40 g/t Ag.

DEVELOPMENTS Exploration for additional reserves continued at Halfmile Lake, but a feasibility study performed by Brunswick could not justify further property development at the time. The results of a two-dimension (2-D) seismic survey shot in 1995 warranted a second seismic line along the Otter Brook, which was shot in the latter part of 1996. The 2-D seismic line was followed up in 1997 with one deep drill hole that intersected a pyrrhotite–pyrite–chalcopyrite-bearing chloritic mudstone unit at the predicted depth of the seismic reflector. This unit is thought to be the equivalent of the mineralized horizon at the known deposits, but nothing encountered in the hole could account for the massive-sulphide-type reflective response in the seismic survey. The response is presumably coming from either side of the drill hole. Consequently, line cutting was completed in the fall of 1997 in preparation for a 3-D seismic survey that was completed in 1998. Diamond drilling continues on the property.

Sewell Brook Zinc, Lead, Copper

LOCATION The Sewell Brook zinc, lead and copper deposit (Figure 7: 44b) is 25 km northeast of Plaster Rock, about 1.3 km from the confluence of Sewell Brook and North Branch Gulquac River in Victoria County (Lat. 47° 0.9' and Long. 67° 7.2' ; NTS 21 O/03E). It is accessible via Fraser Company logging roads from Plaster Rock.

RIGHTS In 1998, NovaGold Resources Inc. held 182 mineral claims under the *Mining Act*, Chapter M-14.1, S.N.B. 1985 in the Sewell Brook area, and another 65 in a contiguous claim group.

COMPANY NovaGold Resources Inc. The head office address is: Suite 300, 3 Spectacle Lake Drive, Dartmouth, Nova Scotia B3B 1W8. Telephone: (902) 468-9270. The President is Mr. Gerald J. McConnell, and the Vice-President of Canadian Operations is William L. Young.

HISTORY Disseminated mineralization was discovered in outcrop during a New Brunswick Department of Natural Resources and Energy regional mapping program carried out in 1989. Following the release of regional lithogeochemical data showing highly anomalous values in the Sewell Brook area, NovaGold carried out staking that was followed by soil sampling, VLF electromagnetic, magnetic and induced polarization (IP) surveys. An IP/geochemical anomaly was drilled in October 1990 that intersected three sulphide zones. Between October 1990 and March 1991, NovaGold (and joint venture partner Costigan Gold Corp.) drilled 45 holes, outlining a small (approximately 25000 t) massive, high-grade zone as well as other lower-grade zones. In May 1991, NovaGold Resources Inc. announced a joint venture agreement with Kennecott Canada Inc. Additional gravity and IP surveys were carried out and one hole was drilled in March 1993.

GEOLOGY The Sewell Brook area is underlain dominantly by intercalated felsic volcanic and sedimentary rocks, and minor mafic volcanic rocks of the Lower Devonian Tobique Group. Felsic volcanic rocks comprise massive rhyolite flows with associated carapaces of hyaloclastic breccia or microbreccia; some pumiceous lapilli tuff has also been identified. Sulphides are hosted mainly by chloritic or sericitic altered felsic fragments interpreted as flow-margin hyaloclastites, generally at or near the contact with overlying, typically silicified siltstones. Most of the mineralization appears to have replaced the host felsic fragmental rocks; the mineralization is stratabound to the extent that it preferentially replaces porous beds. Some massive sulphide intersections are reported to be banded, suggesting deposition as seafloor exhalites; however, mineralization also occurs as disseminations, veinlets or cavity fillings in massive rhyolite. The best intersections reported by NovaGold were 5.72 m of 40.97% Pb+Zn, and 5.03 m of 36.09% Pb+Zn. Local Cu-rich zones occur stratigraphically below the Pb–Zn zones, and returned assays of 3.72% Cu over 10.15 m, and 17.44% Cu and 7.08% Zn over 1.5 m. Chapleau confirmed the earlier assays in the Discovery Zone, and also intersected high-grade mineralization in the Brook Zone. The latter was interpreted as the fault-offset southern continuation of the Discovery Zone; best grades reported were 10.59% Cu+Pb+Zn over 19.9 m, and 10.12% Cu+Pb+Zn over 32.6 m (including 23.81% Cu+Pb+Zn over 5.2 m). Two other mineralized zones were reported at deeper stratigraphic levels: the upper is characterized by low-grade Pb and Zn, and local Cu enrichment (1.9% over 17 m, including 3.8 m of 5.7% Cu), whereas the lower is a copper zone with grades up to 1.9% Cu over 6.6 m. Numerous additional mineralized intercepts were identified, along with local Au and Ag enrichment (e.g., 0.046 oz./ton Au [1.58 g/t] and 5.33 oz./ton Ag [182.7 g/t] over 2.35 m).

RESERVES A Chapleau Resources Limited press release dated February 7, 1997 reported that drilling had outlined a roughly 6 000 000 t potential resource [Note: not a probable or proven resource] of open pittable material grading 3.5–4.5% Cu+Pb+Zn, with a higher-grade central zone of 1 500 000–2 000 000 t grading 7–8% combined Pb+Zn+Cu+Ag. The minimum areal extent of this zone was said to measure 380 x 230 m (March 20, 1997 press release).

DEVELOPMENTS In May 1996, Chapleau Resources Limited entered into an option agreement with NovaGold Resources to earn a 50% interest in the Sewell Brook deposit. By spring of 1997, an additional 45 holes had been drilled at Sewell Brook, confirming and extending the original (Discovery) zone, and identifying other mineralized horizons. No additional work has been done since that time.

INDUSTRIAL MINERALS

Limestone, Gypsum, Anhydrite

Limestone deposits of the Carboniferous (Lower Viséan) Windsor Group were the target of several exploration programs in 1997–98. Havelock Lime, a division of Goldcorp Inc. has explored three southern New Brunswick properties with excellent potential for sources of high-calcium limestone (>95% $CaCO_3$). In the Buckley Road area (Figure 6: 31), about 10 km north of Havelock Lime's processing facility at Havelock, the company undertook an extensive air track- and diamond-drilling program that roughly outlining about 2 000 000 t of high-calcium limestone. A similar air track-drilling project, begun in 1997, to confirm the extent and quality of limestone on a property less than a kilometre west of the old Glebe mine site (Figure 6: 32), 15 km southeast of the town of Sussex, was also completed. A test quarry was established on Havelock Lime's Hicksville limestone property (Figure 6: 33), 2 km northwest of the company's lime operation, to test its suitability for making various calcined products. Results appear encouraging and additional definition drilling is planned prior to a production decision.

Lafarge Canada Inc., also situated near Havelock, undertook some additional definition drilling on its Springhill limestone property (Figure 6: 33), 7 km west of the company's cement distribution terminal.

Almost 16 000 000 t of probable reserves of high-calcium limestone are estimated for the property. Lafarge also drilled a hole near the western limit of its Glenvale gypsum property (Figure 6: 33), 3 km north of Petitcodiac.

Neoproterozoic carbonates and associated rocks of the Ashburn Formation, 25 km northeast of Saint John, were the focus of an extensive air track-drilling program in preparation for a potential quarry operation (Figure 6: 34) proposed by J.D. Irving Limited.

Ken Whaley of Mactaquac Mining Ltd. undertook a detailed diamond-drilling program this year on his Hillsborough and Demoiselle anhydrite/gypsum properties (Figure 6: 35), 20 and 25 km south of Moncton, respectively. It is reported that 18 000 000 t of high-purity anhydrite have been outlined at Hillsborough while roughly 5 000 000 t (drill-indicated) have been outlined at Demoiselle. Interest in anhydrite originates from a planned research project investigating the production of high-grade calcium and sulphur products through a process that consists of combining anhydrite and high-sulphur coal.

In northwestern New Brunswick, the Plaster Rock Gypsum and Manufacturing Company continued working toward the establishment of agricultural gypsum and lime operations. In an effort to further delineate limestone resources in the region, an air track-drilling program was conducted near Wapske (Figure 6: 36), just south of the Village of Plaster Rock.

Titanium

In his continuing research into various mineral commodities in southeastern New Brunswick, Avard Hudgins has observed the potential for TiO_2 in paleoplacer deposits of rutile and anatase in the Lower Carboniferous Mabou Group. During a recent drilling program in the Lower Coverdale area (Figure 6: 37) south of Moncton, Noranda Inc. intersected a high-grade, titanium-bearing saprolitic horizon at the base of the Westphalian Boss Point Formation. Mr. Hudgins has observed extensive black sand deposits concentrated in alluvium of a river adjacent to this buried deposit and has established two large claim blocks in the region. One follows the channel of the Petitcodiac River between Moncton and Fort Folly Point and the other is west of Taylor Village (Figure 6: 38).

Dimension Stone

Southwest of Sackville, Maritime Stone Works Inc., a company specializing in dimension stone products, has been evaluating the establishment of a new quarry site southeast of Moncton.

Potash, Salt

The Millstream potash prospect (Figure 6: 39), 5–10 km west of Sussex, was first explored by BP Resources Canada Ltd. in the early 1980s. Mineral rights to the deposit reverted back to the Province in the early 1990s. IMC Kalium subsequently re-evaluated the deposit in 1996 but opted not to proceed with further evaluation of the property. The mineral rights to the property were once again returned to the Province in 1997.

The Province of New Brunswick owns the mineral rights to this deposit, which presently remains undeveloped despite the existence of several potash horizons, ranging in thickness from 6.1 to 38.0 m at depths between 950 and 1050 m below surface. Total *in situ* geological reserves have been estimated at 256 000 000 t grading 20.6% K_2O.

Although interest in the Millstream potash prospect has been centered mainly on its potash mineralization, a potentially large magnesium resource is associated with it, in the form of carnallitite, an admixture of the minerals, carnallite ($KClMgCl_2 \cdot 6H_2O$) and halite ($NaCl$). A very preliminary estimate indicates a carnallitite resource of more than 100 000 000 t. However, only about half the prospect has been explored and there remains a very good possibility that additional potash/magnesium resources may be present in unexplored portions of the property. Pending more detailed examination, it would seem that the development of the Millstream property could depend on multi-product recovery (potash, magnesium and rock salt) and on establishing a suitable method of recovery. Considering alternative methods of extraction like solution mining, in light of regional availability of natural gas and the deposit's strategic location near an established port facility and world markets, the Millstream deposit may deserve re-assessment.

Peat

Fourteen new applications for peat exploration licences on Crown lands were received in 1998: Peatlands 14, 27, 29, 52, 115, 153 and 324N by Premier Horticulture ltée; Peatlands 343 and 507 by Lucien Chiasson; Peatland 574 by La Mousse Acadienne (1979) ltée; Peatlands 25 and 577 by Le Groupe Qualité Lamèque ltée; Peatland 305 by Envirem Technologies Inc.; and a group of small peatlands near Grand-Sault (Burgess Settlement area) by Guy Côté. One option request was submitted by Le Groupe Berger ltée for Peatland 356.

Two peat exploration licences were issued: Licence 98-1 to Premier Horticulture ltée for Peatland 14 and Licence 98-2 to La Mousse Acadienne (1979) ltée for Peatland 574. Three options were issued to Sun Gro Horticulture Canada Ltd. for Peatlands 4, 5 and 6. Four licence applications were rejected: Lucien Chiasson (Peatlands 343 and 507), Envirem Technologies Inc. (Peatland 305), and Saint John River Valley Tribal Council (Peatland 792). One licence lapsed at the end of its term: Les Tourbes M.L. ltée (Peatland 785A).

On December 31, 1998, ten exploration licence applications were under review: La Cie de Tourbe Fafard Ltée (Peatland 552), Le Groupe Qualité Lamèque ltée (Peatlands 25 and 577), Guy Côté (Burgess Settlement area), and Premier Horticulture ltée (Peatlands 27, 29, 52, 115, 153 and 324N). Two option applications were under review: Le Groupe Berger ltée (Peatland 356) and Theriault & Hachey Peat Moss Ltd. (Peatland 304A).

The temporary moratorium on new peat extraction projects on Lamèque Island ended on February 18, 1998. Exceptionally, the term of Peat Exploration Licence 93-1 (La Tourbe de Petite-Lamèque) was extended to February 17, 1999.

Premier Horticulture ltée

COMPANY Premier Horticulture ltée, 1, ave Premier, C.P. 2600, Rivière-du-Loup, Québec G5R 4C9. The contact person is Michel Vachon, Director of operations. Telephone: (418) 862-6356.

RIGHTS Peat Exploration Licence 98-1 (202 ha) on Peatland 14, under the *Quarriable Substances Act*, Chapter Q-1.1, S.N.B. 1991.

LOCATION Peatland 14 is 30 km west of Rogersville, Northumberland County (Figure 6: 40).

HISTORY Premier Horticulture ltée received an option in 1996. The company applied for an exploration licence early in 1998. Licence 98-1 was issued on May 28 of the same year.

RESERVES AND GRADE 1.73 Mm^3 surficial peat; average depth 1.5 m; average humification 2.9 von Post.

La Mousse Acadienne (1979) ltée

COMPANY La Mousse Acadienne (1979) ltée, C.P. 2002, Lamèque, New Brunswick E8T 3N3. Telephone: (506) 344-2225. The Manager is Gilles Haché.

RIGHTS Peat Exploration Licence 98-2 (26 ha) on Peatland 574, under the *Quarriable Substances Act*, Chapter Q-1.1, S.N.B. 1991.

LOCATION Peatland 574 is located in Cap-Bateau, Gloucester County (Figure 6: 41).

HISTORY La Mousse Acadienne (1979) ltée had been issued a licence in 1994 but abandoned its project in 1996. In 1998, the company expressed its renewed interest by applying for an exploration licence. Peat Exploration Licence 98-2 was issued in June of the same year.

RESERVES AND GRADE 2.07 Mm^3 surficial peat; average depth 2.1 m; average humification 3.1 von Post.

Jiffy Products (N.B.) Ltd.

COMPANY Jiffy Products (N.B.) Ltd., C.P. 2004, Parc industriel, Shippagan, N.B. E8S 3H1. The Manager is Alonzo Dupuis. Telephone: (506) 336-2284.

RIGHT Peat Lease No. 32 (268 ha) on Peatland 536 under the *Quarriable Substances Act*, Chapter Q-1.1, S.N.B. 1991.

LOCATION Peatland 536 is located 8 km north of Tracadie-Sheila, between Pont-Landry and Ste-Rose, Gloucester County (Figure 6: 42).

HISTORY Jiffy Products (N.B.) Ltd., a subsidiary of Jiffy Products International, Oslo, Norway, established a peat pot and pellet manufacturing plant in Shippagan in 1975. In 1982, the company was issued a Peat Exploration Licence for Peatland 536. A Peat Lease was granted in 1989 to guarantee a long-term supply of quality peat moss for the manufacturing plant.

RESERVES AND GRADE 5.64 Mm^3 surficial peat; average depth 2.6 m; average humification 3.4 von Post.

DEVELOPMENT No new development. Peatland 536 is considered a reserve for future needs.

La Tourbe de Petite-Lamèque

COMPANY La Tourbe de Petite-Lamèque, P.O. Box 46, Lamèque, NewBrunswick E0B 1V0. The President is Lucien Chiasson. Telephone: (506) 344-8120.

RIGHTS Peat Exploration Licence 93-1 (42 ha) on Peatland 577, under the *Quarriable Substances Act*, Chapter Q-1.1, S.N.B. 1991.

LOCATION Peatland 577 is at Pointe-Canot, 5 km northwest of Lamèque, Gloucester County (Figure 6: 43).

HISTORY La Tourbe de Petite-Lamèque applied for and received a peat exploration licence in 1993. An application for a Peat Lease was submitted in 1993. The project was put on hold in 1995 pending the lifting of a temporary moratorium on new peat extraction projects on Lamèque Island. The moratorium ended on February 18, 1998 and the term of the licence was extended to February 17, 1999.

RESERVES AND GRADE 1.44 Mm^3 surficial peat; average depth 2.7 m; average humification 3.1 von Post.

Les Tourbières M. L. Ltée

COMPANY Les Tourbières M.L.Ltée, P.O. Box 307, Rivière-du-Loup, Québec G5R3Y9. The President is Marcel Lévesque. Telephone: (418) 862-6233.

RIGHTS Peat Exploration Licence 96-1 (463 ha) on Peatland 785A, under the *Quarriable Substances Act*, Chapter Q-1.1, S.N.B. 1991.

LOCATION Peatland 785A is located 3 km west of Pokiok Settlement, York County (Figure 6:44).

HISTORY The company applied for a peat exploration licence in 1995. A licence was issued in October 1996. The licence lapsed at the end of its term, on October 15, 1998.

RESERVES AND GRADE 8.76 Mm^3 surficial peat; average depth 2.1 m; average humification 3.3 von Post.

Hydrocarbons and Underground Storage

Oil and Natural Gas

Corridor Resources Inc.

COMPANY Corridor Resources Inc., Suite 301, 5475 Spring Garden Road, Halifax, Nova Scotia B3J 3T2.

RIGHTS Oil and Natural Gas On-shore Licence to Search 95-02 (35165.3 ha), 95-03 (15774.0 ha), 95-04 (20072.4 ha), 95-05 (7762.9 ha), 97-02 (11 883 ha). 97-03 (35 930 ha), 97-04 (17 950 ha), 98-09

(18 005 ha), and 98-10 (17 980 ha) under the *Oil and Natural Gas Act*, Chapter O-2.1, R.S.N.B. 1976.

LOCATION Licences 95-02, 95-03, 95-4 and 95-05 are in the Dorchester to Port Elgin area (Figure 6: 45a) of Westmorland County (NTS 21 I/1, 21 H/16). Licences 97-02, 97-03, 97-04, 98-09 and 98-10 are in the Moncton Subbasin between Moncton and Sussex (Figure 6: 45b) in Kings, Westmorland and Albert counties (parts of NTS 21 H/13, 14, 15, 16; 21 I/01, 02).

HISTORY Corridor continued to examine existing public geological and geophysical data in the Sackville and Moncton subbasins. The company increased its exploration rights with two licence areas (98-09 and 98-10) as a result of successful bids in Call for Tenders #14. The company acquired 12 km of seismic reflection data in the Havelock area on Licence 97-04. A drilling prospect was assessed from seismic data previously shot in the Elgin area on Licence 97-02.

OUTLOOK In 1998, the company continued to solicit partnership arrangements in order to share the cost of drilling its prospect.

Irving Oil Limited

COMPANY Irving Oil Limited, P.O. Box 1421, Saint John, New Brunswick E2L 4K1.

RIGHTS Oil and Natural Gas On-shore Lease 74-1 (2153.7 ha), under the *Oil and Natural Gas Act*, Chapter O-2.1, R.S.N.B. 1976.

LOCATION Lease 74-1, in the Stoney Creek field (Figure 6: 46) is 16 km south of Moncton in Albert County (NTS 21 H/15).

HISTORY Lease 74-1 is in the fifth year of the third ten-year term. There has been no oil production from the field since 1988 and no natural gas production since 1991.

OUTLOOK Discussions continued with the lessee concerning the status of the wells on the lease and development of a schedule for well abandonment.

Jean Mariadassou

COMPANY Jean Mariadassou, Suite 304, 7100 Bombardier, Anjou, Québec H1H 2G2.

RIGHTS Oil and Natural Gas On-shore Licence to Search 97-01 (10 522 ha) under the *Oil and Natural Gas Act*, Chapter O-2.1, R.S.N.B. 1976.

LOCATION The licence area is in northwestern New Brunswick, just northeast of St. Leonard (Figure 6: 47) in Madawaska County (NTS 21 O/04, 05).

HISTORY A dispute with the land owner, J.D. Irving Limited, regarding the right of entry was resolved in 1997. The evaluation of the hydrocarbon potential of the area was initiated by Mr. Mariadassou as a result of drilling Notre Dame de Lourdes #1 in March. Drilling was suspended at 275 m.

OUTLOOK The licensee continues to examine geological data for the area and hopes to deepen the well in future.

MariCo Oil and Gas Corporation

COMPANY MariCo Oil and Gas Corporation, 391 Brunswick St., Fredericton, New Brunswick E3B 1H2.

RIGHTS Oil and Natural Gas On-shore Licence to Search 93-02 (33411.5 ha), 97-05 (35 823 ha), 97-06 (35 823 ha), 97-07 (17 898 ha), 97-08 (35 717 ha), 97-09 (35 717 ha), 98-01 (34 593 ha), 98-02 (35 930 ha), 98-03 (25 155 ha), 98-04 (10 779 ha), 98-05 (10 746.9), 98-06 (19 336 ha), 98-07 (35 717 ha), and 98-08 (15 352.9 ha) under the *Oil and Natural Gas Act*, Chapter O-2.1, R.S.N.B. 1976.

LOCATION Licence area 93-02, located 10–20 km south of Moncton in the Turtle Creek area (Figure 6: 48a) of Albert County (NTS 21 H/15), is immediately west and along strike of the previously productive Stoney Creek oil and gas field. The 97-05 to 97-09 licences are located north and west of Moncton Figure 6: 48b) in the counties of Albert, Kings, Kent, Queens and Westmorland, while the 98-01 to 98-08 licences are located northeast, east and south of Fredericton (Figure 6: 48c) in Sunbury and York counties.

HISTORY Licence to Search 93-02 was issued in July 1993 to Ardent Resources Inc. and subsequently transferred to MariCo. A farm-in by the company on Seglund's 93-01 and the acquisition of eight additional licence areas as a result of Call for Tenders # 14 increased its exploration rights to some 411 100 ha. The company drilled and abandoned two exploration wells in the Steeves Mills area, about 10 km southwest of the Stoney Creek field. While drilling Downey #1, a significant gas show was made in the third test well on Seglund's 93-01 licence area at a site near the former Irving/Chevron Hillsborough No. 1 well.

OUTLOOK The company continued to assess the potential of Downey #1 well, at the same time seeking investment partners to enable further examination and exploration of the potential resources.

J.A. Seglund Inc.

COMPANY J.A. Seglund Inc., 9825 Ana Hula St., Diamond Head, Mississippi, U.S.A. 39525-4400.

RIGHTS Oil and Natural Gas On-shore Licences to Search 91-01 (10 058.3 ha), 93-01 (10057.1 ha), and 95-01 (8990.5 ha) under the *Oil and Natural Gas Act*, Chapter O-2.1, R.S.N.B. 1976.

LOCATION The licences are about 15 km south of Moncton in the Albert Mines to Saint-Joseph area, on both sides of the Petitcodiac and Memramcook rivers (Figure 6: 49) in Albert and Westmorland counties (NTS 21 H/15).

HISTORY Licence to Search 91-01 was granted on March 4, 1991. Licence to Search 93-01 was issued on July 12, 1993 and Licence to Search 95-01 on February 14, 1995. A farmout agreement with MariCo Oil and Gas Corporation of Fredericton, New Brunswick and the subsequent drilling of Downey #1 well on 93-01 resulted in the discovery of natural gas. (see MariCo, above).

OUTLOOK MariCo intends to drill two "step-out wells," a kilometre on each side of the discovery well, to prove up the gas reservoir with production quantities of gas.

RHT Enterprises Ltd.

COMPANY RHT Enterprises Ltd., 69 Biddington Ave., Lakeville, Westmorland County, New Brunswick E1H 1C2.

RIGHTS Oil and Natural Gas On-shore Licences to Search 92-01 (10 735.4 ha) and 92-02 (22 151.2 ha) under the *Oil and Natural Gas Act*, Chapter O-2.1, R.S.N.B. 1976.

LOCATION The licence areas are northeast of Moncton between Lakeville and Cocagne (Figure 6: 50) in Westmorland and Kent counties (NTS 21 I/02, 07).

HISTORY The licences were issued in January 1992 to Lakeside Estates Ltd. and in May 1992 were transferred to RHT Enterprises Ltd. of Moncton. Following an assessment of seismic reflection profiles on its licence area, the licensee spudded a well, RHT Lakeside #1. The well was plagued with numerous water zones and caving shales and, in 1994, the company submitted a request to the Department of Environment to convert the status of the well from an oil and natural gas exploration hole to a water well. RHT Lakeside #2, spudded in 1994, remains suspended.

OUTLOOK The company intends to re-enter RHT Lakeside #2 and complete the well when adequate funding can be secured.

Bituminous Shale

A.A. (NB) Inc.

COMPANY A.A. (NB) Inc., P.O. Box 3133, Station B, Fredericton, New Brunswick E3A 5G9.

RIGHTS Bituminous Shale Development Permit 97-01 (762.5 ha), 97-02 (314.6 ha), and 97-03 (652 ha) under the *Bituminous Shale Act*, Chapter B-4.1, R.S.N.B. 1976.

LOCATION Development Permit 97-01 is located near Dover (Figure 6: 51a) in Westmorland County. Permits 97-02 and 97-03 are located, respectively, at Albert Mines and Rosevale (Figure 6: 51b) in Albert County (NTS 21 H/15).

HISTORY In late 1997, the company opened ten surface trenches with an aggregate length of 936 m. The trenches were dug across high-grade oil shale beds in three locations—Rosevale, Albert Mines, and Dover. The trenches were mapped in detail and channel samples were collected for Rock-Eval pyrolysis. As a result of the conversion of Licence to Search 96-01 to three Development Permits in 1997, the company reduced its land holdings to 1729 ha. Evaluation and further trenching continued in 1998, which resulted in the surrender of the 97-03 permit area at the end of the first year.

Shell Canada Limited

COMPANY Shell Canada Limited, 400-4th Avenue S.W., P.O. Box 100, Station M, Calgary, Alberta T2P 2H5.

RIGHTS Bituminous Shale Licence to Search 98-01 (24 610 ha) under the *Bituminous Shale Act*, Chapter B-4.1, R.S.N.B. 1976.

LOCATION Bituminous Shale Licence to Search 98-01 extends from Prosser Brook in Albert County across the Peitcodiac and Memramcook rivers to College Bridge (Figure 6:52) in Westmorland County (NTS 21 H/15).

HISTORY Upon closing (April 22, 1998), Shell Canada Limited submitted the successful bid in the Call for Tenders #15. The aggressive $1 000 000 work commitment resulted in the company completing an eight-well bituminous shale (oil shale) evaluation program by year's end. The eight wells yielded a total of 5226 m of core.

OUTLOOK The company will analyze the data with a view to continuing its exploration program in 1999.

Underground Storage

St. Clair Pipelines (1996) Ltd.

COMPANY St. Clair Pipelines (1996) Ltd., 50 Keil Drive North, Chatham, Ontario N7M 5M1

RIGHTS Underground Storage Exploration Licences 96-01 (898.5 ha) and 96-02 (1167.7 ha) under the *Underground Storage Act*, Chapter U-1.1 R.S.N.B. 1978.

LOCATION Licence 96-01 is in the Dorchester area and 96-02 is in the Point de Bute area (Figure 6: 53) of Westmorland County (NTS 21 H/10, 16).

HISTORY These two three-year nonrenewable licences were granted on February 23, 1996.

OUTLOOK St. Clair Pipelines (1996) Ltd. carried out a preliminary feasibility study and a regional geology survey to assess both sites.

Intragaz

COMPANY Intragaz, 6565, boul. Jean XXIII, Trois-Rivières-Ouest, Québec G9A 5C9.

RIGHTS Underground Storage Exploration Licences 97-01 (628.1 ha), 97-02 (1799.3 ha), 97-03 (924.4 ha), 97-04 (2455.2 ha), 97-05 (7458.7 ha), 97-06 (2353.9 ha), 97-07 (1532.8 ha), 97-08 (2152.7 ha), 98-01 (15 363.1 ha), and 98-02 (650.4 ha) under the *Underground Storage Act*, Chapter U-1.1 R.S.N.B. 1978.

LOCATION Licence 97-01 (Baie Verte), 97-02 (Johnson Creek), 97-03 (Millstream), 97-04 (Plumweseep), 97-05 (Sackville), 97-06 (Smithtown), 97-07 (Sussex) and 97-08 (Weldon–Gautreau), 98-01 (Port Elgin-Coppermine), and 98-02 (Uniacke Hill) are located in Kings, Albert and Westmorland counties.

HISTORY Intragaz was granted eight licences to explore for and evaluate underground storage potential for fluids in southern and southeastern New Brunswick. The company has retained Licences 97-01, 97-02 and 97-05 in the Baie Verte, Johnson Creek and Sackville areas (Figure 6: 54a). Licence areas 97-03 (Millstream), 97-04 (Plumweseep), 97-06 (Smithtown), 97-07 (Sussex) and 97-08 (Weldon–Gautreau) were surrendered after the first year, citing the location as too risky to carry on exploration. Later in the year, licences were granted to explore the Port Elgin–Coppermine and Uniacke Hill (Figure 6: 54b) areas.

OUTLOOK The company continued to assess pre-existing geological and geophysical data available for their licence areas.

CHAPTER 3. MINES AND QUARRIES

VALUE OF MINERAL PRODUCTION

Production Statistics

The 1998 value of mineral production (including coal) in New Brunswick is estimated to be $852 217 726, representing a decrease of approximately 11% from the final value of $953 071 135 for 1997 (Tables 4 and 5, Figure 8). The decrease can be attributed equally to reduced production in the nonmetals sector and to a sharp drop in the zinc price. Potash production was lower as a result of the loss of the Potacan mine, which was flooded in 1997. In the metals sector, higher production of metal partly offset lower prices, but not sufficiently to overcome fully the impact of the price decreases. The zinc price was the most significant factor affecting revenues in the metals sector, as the average price of zinc fell by 22% between 1997 and 1998. Mitigating the impact of lower prices, the value of the Canadian dollar relative to the US dollar declined by 6.6%, averaging US 67.5¢ for the year.

The value of metal production in 1998 was $602 521 024, which represents 71% of the value of mineral production for the Province. Two of the Province's metal producers, Noranda Inc.'s Brunswick and Heath Steele mines, achieved higher throughput. Also, CanZinco Ltd.–Caribou Mine Division ramped up production after a mid-1997 start-up. Unfortunately, low metal prices and metallurgical difficulties forced a suspension of operations at the Caribou mine in August.

Table 4. Value of Mineral Production* in New Brunswick, 1984 to 1998
(Source: Natural Resources Canada)

Calendar Year	Metals ($)	Nonmetals ($)	Fuels ($)	Structural Materials ($)	Total ($)
1984	497 981 000	47 973 438	29 837 000	42 178 000	617 969 438
1985	364 825 000	62 025 000	31 025 000	43 727 000	502 203 000
1986	312 466 000	118 813 000	28 027 000	42 264 000	501 570 000
1987	391 836 000	152 481 000	33 347 000	44 567 000	622 231 000
1988	604 045 000	226 908 000	33 530 000	46 319 000	910 802 000
1989	582 439 000	210 998 000	33 740 000	45 896 000	864 073 000
1990	584 491 926	208 784 840	37 200 000	47 449 277	877 926 043
1991	375 427 470	220 185 000	34 185 000	41 663 590	671 475 483
1992	594 174 162	243 745 074	32 200 000	38 001 869	908 121 105
1993	489 912 908	208 094 381	33 800 000	40 042 060	771 849 349
1994	543 445 558	252 225 522	28 450 000	37 923 292	862 044 372
1995	670 694 700	281 088 407	24 410 000	44 459 331	1 020 652 438
1996	586 293 968	301 627 615	24 030 000	42 731 027	954 682 610
1997	657 532 566	238 936 898	18 190 000	38 411 671	953 071 135
1998(P)	602 521 024	186 457 073	23 090 000	40 149 629	852 217 726

(P) Preliminary figures; * Current dollars

Table 5. Mineral Production in New Brunswick, 1997 and 1998
(Source: Natural Resources Canada)

Commodity	Unit	1997 Final		1998 Preliminary	
		Quantity	Value ($)	Quantity	Value ($)
Metals					
Antimony	kg	*	*	*	*
Bismuth	kg	181 821	1 817 483	201 550	2 255 748
Cadmium	kg	95 736	149 827	135 320	129 366
Copper	kg	13 627 144	43 143 538	14 552 957	35 785 721
Gold	g	*	*	*	*
Lead	kg	72 452 946	62 599 345	81 751 982	63 603 042
Silver	kg	242 846	52 887 203	254 283	66 914 629
Zinc	kg	270 240 185	492 377 617	285 233 328	429 561 392
TOTAL			657 532 566		602 521 024
Nonmetals					
Marl	t	*	*	*	*
Peat	t	430 429	55 199 486	396 538	53 816 737
Potash	t	*	*	*	*
Quartz (silica)	t	*	*	*	*
Salt	t	*	*	*	*
Sulphur (in smelter gas)	t	82 057	6 098 476	93 359	6 498 720
TOTAL			238 936 898		186 457 073
Fuels					
Coal	t	170 000	18 190 000	280 000	23 090 000
TOTAL			18 190 000		23 090 000
Structural Materials					
Lime	t	*	*	*	*
Sand and Gravel	t	4 183 406	8 494 249	4 075 267	*
Stone	t	3 933 882	20 292 722	3 174 592	19 256 353
TOTAL			38 411 671		40 149 629
GRAND TOTAL (CDN)			$953 071 135		$852 217 726

* confidential information

GRAND TOTAL 1996 (CDN $) $ 954 682 610

Zinc continued to dominate the metals sector with a value of $429 561 392, which represents 71% of the total value of metals. The value of zinc production decreased approximately 13% from 1997, despite an increase of 6% in the total amount of zinc produced. This increase in production was accompanied by a 22% drop in the average price of zinc between 1997 (59.8 ¢/lb. [U.S.]) and 1998 (46.5 ¢/lb. [U.S.]). Lead contributed $63 603 042 to the value of metal production, up slightly (2%) from the 1997 value. Production of lead rose by 13%. The 1998 average London Metal Exchange price for lead was 24.0 ¢/lb. (U.S.), down from 28.3 ¢/lb. (U.S.) in 1997, a decrease of 15%. The value of copper production

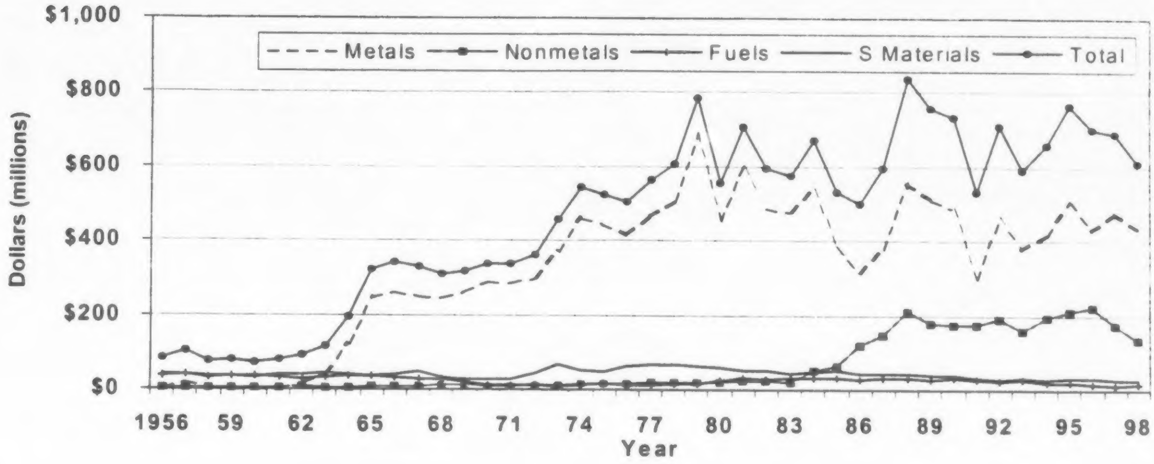


Figure 8. Value of mineral production in New Brunswick, 1956–1998. Abbreviation: S Materials–structural materials. Source: Natural Resources Canada. [$1986 = 100]

decreased by 17%, to $35 785 721. This is attributable to a 27% price decrease ($0.75/lb. in 1998 vs. $1.03/lb. in 1997), as production actually increased by 7%. Antimony, bismuth and cadmium continued to be produced as by-products from the Brunswick operation. The value and total production of antimony decreased. The value of bismuth increased, reflecting an increase in both the price and amount produced. Although production of cadmium increased substantially, the value fell because of a further decline in the price since 1997. Gold production was up slightly over 1997, but the value fell as the price decreased by approximately 10%. Silver production was up about 5% over 1997 and the value increased substantially, as the price rose by 13%.

The nonmetals sector of the industry contributed $186 457 073 (22%) to the value of mineral production, a 22% decrease from the 1997 value. The largest contributor to the value of nonmetals production is potash. The value of potash decreased 31%, while production decreased 32% from 1997 levels. Peat, the second largest contributor ($53 816 737) to the value of nonmetals production, represented 29% of the value of nonmetals. Both the amount and value of production were lower than in 1997. Salt and sulphur in smelter gas ranked next in value of production, while quartz and marl were minor contributors to the nonmetals sector.

The value of coal produced by N.B. Coal Limited in the Minto–Chipman area rose by 27% to $23 090 000. Coal production increased by 65% from 1997, while shipments were similar to the previous year's.

The value of production for structural materials (lime, stone, sand and gravel) increased 5% to $40 149 629. Sand and gravel production was almost unchanged, while stone production decreased by 19%. These commodities provide the raw material for the construction industry in New Brunswick.

New Brunswick continues to rank first among Canadian provinces and territories in its value of production for zinc, lead, bismuth and peat, and second in silver, antimony and potash (Table 5).

EMPLOYMENT

The mineral industry employed an average of 3868 people in 1998. The following shows employment (permanent and seasonal) by sector in the mineral industry for 1998:

Metals	2158	Peat	1144
Potash	348	Structural Materials	124
Coal	94	Total	3868

METALLIC MINERALS

Noranda Inc.—Brunswick Mine

COMPANY Noranda Inc.—Brunswick Mine (formerly known as Noranda Mining Inc.—Brunswick Mining Division). Head Office: P.O. Box 755, Ste 4100, BCE Place, 181 Bay St., Toronto, Ontario M5J2T3. Telephone: (416) 982-7111; Mine Office: P.O. Box 3000, Bathurst, New Brunswick E2A 3Z8; Smelter Office: P.O. Box 2000, Belledune, New Brunswick E0B 1G0. The Chief Operating Officer is David Goldman, the President is Jean Desrosiers and the Mine Manager is John Martin.

RIGHTS In 1962, Brunswick Mining and Smelting Corporation Limited was granted surface and mineral rights to the No. 12 mine property.

LOCATION Brunswick owns Canada's largest zinc deposit and operates one of the world's largest zinc mines. The company also operates a concentrator and lead smelter. The Brunswick No. 12 mine (Figure 9: 1a) is about 24 km west of Bathurst in Gloucester County (Lat. 47° 28.5' N and Long. 65° 53.5' W; NTS 21 P/5W). The concentrator is adjacent to the No. 12 mine; the lead smelter (Figure 9: 1b) is at Belledune Point, about 45 km from the No.12 mine.

HISTORY (Early history is described in Miscellaneous Report 13, "New Brunswick's Mineral Industry, 1993.")

In 1996, the mine experienced heightened seismic activity underground, which resulted in some production areas becoming unavailable for mining. The company subsequently announced a reduction in its production rate from 10 500 t/d to 9 000 t/d.

EMPLOYEES In 1998, there were, on average, 1101 regular and contract employees at the mine and 589 employees at the smelter.

RESERVES Proven ore reserves: 33 961 000 t grading 0.39% Cu, 8.66% Zn, 3.42% Pb, 94.0 g/t Ag

Table 6. Rank of the Provinces and Territories in Value of Production for Leading Minerals in Canada, 1998 (P)

Mineral	NF	PE	NS	NB	PQ	ON	MB	SK	AB	BC	YT	NT	Total Value Canada ($000)
Antimony				2						1			1 302
Bismuth				1						2			2 431
Cadmium				4	2	1				3			1 384
Clay Products	x		x		x	1		x	x	x			135 319
Coal			3	5				4	2	1			1 793 230
Copper				5	3	2	4			1			688 576
Gold	*			*	2	1	x	x		3	*	*	2 322 417
Lead				1						2	4	3	118 029
Lime				x	x	*	x		x	x			220 509
Marl				x									x
Peat	*	*	x	1	2		x	x		3			169 747
Potash				x				x					1 666 976
Salt			x	x	x	1		*	*				399 520
Sand & Gravel	*	*	*	x	4	1	x	x	2	3	*	*	819 893
Silver	8			2	4	3	5	9		1	7	6	293 468
Stone	7		4	6	2	1	5		8	3		9	646 198
Sulphur (in smelter gas)				3	2	1				4			58 315
Sulphur (elemental)			x			x	x	2	1	x			54 321
Zinc				1	3	5	6			4	7	2	1 486 966

Source: Statistics Canada Catalogue 26-202

x Confidential information under the *Statistics Act of Canada*

* Unable to calculate ranking

(P) Preliminary estimate

PRODUCTION In 1998, 3 286 000 t of ore was milled.

Production	Copper	Lead	Zinc	Silver/Bulk
Grade	0.42%	3.37%	8.64%	110 g/t Ag
Recovery	59.88%	61.39%	85.59%	57.71% Ag
Concentrate	36 868 t	122 531 t	405 976 t	82 650 t bulk

The company produces zinc concentrate destined mainly for Noranda's Canadian Electrolytic Zinc refinery in Valleyfield, Québec and a number of refineries in Europe; lead concentrate for the Belledune smelter; bulk concentrate for Europe; and a copper concentrate mainly for the Noranda smelter in Murdochville, Québec.

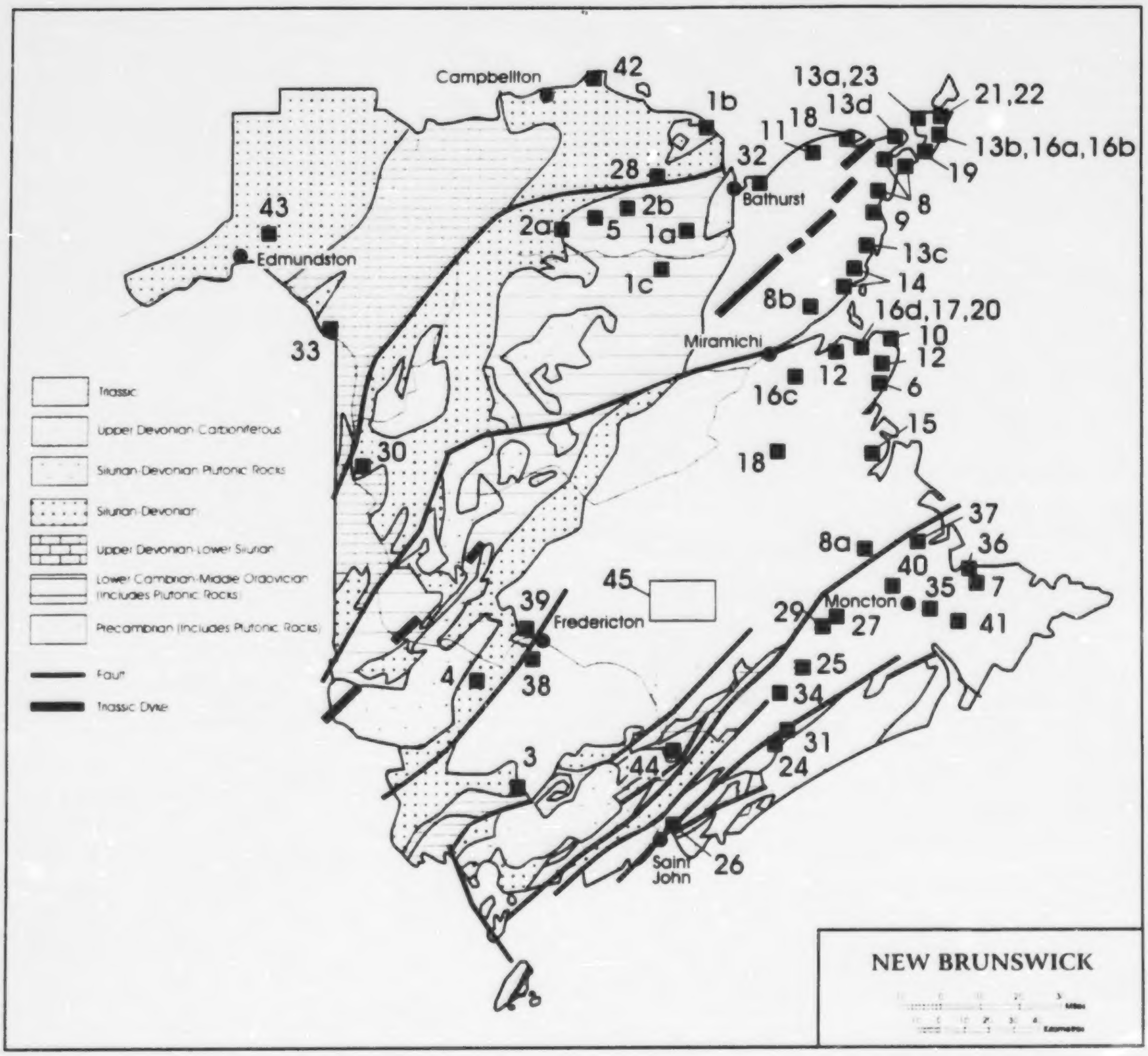


Figure 9. Metallic mineral, industrial mineral, and energy producers in New Brunswick in 1998.

1. Noranda Inc.: (a) Brunswick mine (Pb, Zn); (b) Belledune lead smelter; (c) Heath Steele mine (Cu, Pb, Zn, Ag)
2. CanZinco Ltd.-Caribou Mine Division: (a) Restigouche mine (Zn, Pb, Ag, Cu), (b) Caribou mine (Zn, Pb, Cu, Ag, Au)
3. ADEX Mining Inc., Mount Pleasant mine (Sn, In, W, Mo, Zn, Cu, Bi)
4. APOCAN Inc., Lake George mine (Sb)
5. Murray Brook Resources Inc., a wholly owned subsidiary of NovaGold Resources Inc., Murray Brook mine (Au, Cu, Pb, Zn)
6. ASB Greenworld Ltd..(peat)
7. Beausejour Peat Moss Inc. (peat)
8. La Cie de Tourbe Fafard Ltée (peat): (a) Kent; (b) Burnt Church
9. Les Entreprises Jean-Eudes Martin et Fils Ltée (peat)
10. Good Earth Canada Ltd. (peat)
11. Grande Anse Peat Moss Co. Ltd. (peat)
12. Le Groupe Berger ltée (peat)

12

DEVELOPMENTS A 7% drop in the Canadian dollar exchange rate and higher production partly offset the steep fall in the zinc price. Zinc accounts for approximately 70% of the value of Brunswick's production. Lead, copper and silver represent the remaining 30% of Brunswick's mineral output.

In 1998, Brunswick Mine commissioned a paste backfill system, designed to replace the existing rock fill system. Besides offering cost and environmental benefits, paste fill is expected to enable the company to practise better ground control. In another significant capital project, Brunswick commissioned an autogenous mill in the concentrator, to replace a number of smaller units and improve operating efficiency.

(Figure 9 concluded)

13. Le Groupe Qualité Lamèque ltée (peat): (a) Lamèque; (b) St. Raphaël; (c) Canadian Supreme; (d)Pokesudie
14. Heveco Ltd. (peat)
15. Malpec Peat Moss Ltd. (peat)
16. La Mousse Acadienne (1979) ltée (peat): (a) Acadienne (b) Chiasson: (c) Miramichi; (d) Eel River
17. PaSi Peat Inc. (peat)
18. Premier Horticulture ltée—Division Rogersville (peat)
19. Sun Gro Horticulture Canada Ltd. (peat)
20. Theriault & Hachey Peat Moss Ltd. (peat)
21. La Tourbe de Pigeon Hill Ltée (peat)
22. La Tourbière de Petit-Shippagan (peat)
23. La Tourbière du Centre de l'Île Ltée (peat)
24. Potash Corporation of Saskatchewan Inc. (Cassidy Lake Division) (processing facility)
25. Potash Corporation of Saskatchewan Inc. (New Brunswick Division) (potash, salt)
26. Brookville Manufacturing Company (limestone. dolomite)
27. Lafarge Canada Inc. (limestone)
28. Elmtree Resources Ltd. (limestone)
29. Havelock Lime, a Division of Goldcorp Inc. (limestone)
30. Upper Kent Lime Works Ltd. (marl)
31. Atlantic Silica Inc. (silica)
32. Chaleur Silica (a Division of The Shaw Group) (silica)
33. Brunswick Monuments Ltd. (dimension stone)
34. Nelson Monuments Ltd. (dimension stone)
35. Maritime Stone Works Inc. (dimension stone)
36. Smith Cut Stone and Quarries Limited (dimension stone)
37. Bastarache Stone Quarrie (dimension stone)
38. Diamond Construction Limited (crushed stone)
39. Gray Stone Quarries, a division of Tri Gil Paving and Construction Ltd.; Warren Maritimes Ltd. (crushed stone)
40. Moncton Crushed Stone, a Division of Modern Construction Ltd.; H.E. Carson Limited (crushed stone)
41. Acadia Crushed Stone Division of Modern Construction Ltd.; MacDonald Paving and Construction Limited (crushed stone)
42. C.M. Stewart Company Limited (crushed stone)
43. Clarence Daigle et Fils Ltée (crushed stone)
44. Lafarge Construction Materials (sand and gravel)
45. N.B. Coal Limited (coal)

Noranda Inc.—Heath Steele Mine

COMPANY Noranda Inc.—Heath Steele Mine (formerly known as Noranda Mining Inc. – Heath Steele Division). The head office address is : P.O. Box 755, Ste 4100, BCE Place, 181 Bay St., Toronto, Ontario M5J2T3. The mine office address is P.O. Box 400, Miramichi, New Brunswick E1V 3M5. Telephone: (506) 622-2100. The Chief Operating Officer is David Goldman, the President is Jean Desrosiers, and the Mine Manager is Denis Lachance.

RIGHTS In 1998, the company held Mining Lease 238 (Heath Steele deposit) and Lease 253 (Stratmat boundary deposit) under the *Mining Act*, Chapter M-14.1, S.N.B. 1985.

LOCATION The Heath Steele mine (Figure 9:1c) is 51 km northeast of Miramichi City in Northumberland County (Lat. 47° 17' N; Long. 66° 05' W; NTS 21 O/8). The Stratmat boundary deposit (west zone) is approximately 5 km northwest of the Heath Steele mill complex (Lat. 47° 13' N; Long. 66° 07' W; NTS 21 O/8).

HISTORY (Early history is described in Miscellaneous Report 13, "New Brunswick's Mineral Industry, 1993.")

Production from the C Zone commenced in January 1993 and continued for the first six months. However, in July the company announced that it would be shutting down temporarily (three months) because of low metal prices, in an effort to reduce world metal stocks. Employees participated in a skills upgrading program sponsored jointly by Brunswick Mining and Smelting Corporation Limited and the Provincial and Federal governments. The company did not re-open in September as planned, but in October 1994 when metal prices improved. During the shutdown, the company continued to address environmental concerns associated with the site.

Highway 430, between Heath Steele and Brunswick Mines, was upgraded in the fall of 1995 to extend the use of the road during the spring thaw. This minimized the need to haul south to Miramichi and then north to Bathurst each spring.

GEOLOGY Banded massive sulphides occur as boudins and dismembered layers within a high-strain zone in metasedimentary host rocks. Disseminated sulphides occur in the tectonized and illitized metasediments between the boudins. The massive sulphides consist of fine- to medium-grained interbanded sphalerite–galena and pyrite, with local coarse-grained chalcopyrite. Vaguely banded pyrite–chalcopyrite occurs locally. Disseminated sulphides include medium-grained pyrite and/or sphalerite with smaller amounts of galena and chalcopyrite. The sulphide deposits and the metasediments are sandwiched between two polydeformed sequences of felsic crystal and lapilli tuffs ("Northwall and Southwall sequences"). Gabbro and diabase dykes cut the supracrustal rocks. All rocks are thought to be of Middle Ordovician age (Tetagouche Group). The shapes and attitudes of the sulphide-bearing zones are controlled by two dominant sets of folds.

EMPLOYEES In 1998, 282 regular employees and 28 contractors (average) were on site.

RESERVES The proven and probable reserves at the B mine are 290 400 t of ore grading 0.83% Cu, 6.28% Zn, 2.38% Pb and 91.3 g/t Ag. The proven and probable reserves at the C mine are 477 200 t of ore grading 0.31% Cu, 9.31% Zn, 2.51% Pb and 93.30 g/t Ag.

PRODUCTION In 1998, 942 629 t of ore were milled at the Heath Steele mine.

Production	Copper	Lead	Zinc	Silver
Grade	0.92%	1.63%	6.00%	71.9 g/t
Recovery	75.53%	49.19%	83.55%	45.55%
Concentrate	24 976 t	12 913 t	88 389 t	

The company produces zinc concentrate destined primarily for Europe, lead concentrate for the Belledune smelter, and a copper concentrate mainly for the Noranda smelter in Murdochville, Québec.

DEVELOPMENTS In 1998, the company announced that operations would cease on September 30 1999, when all the recoverable ore was depleted. In the past two years, Heath Steele management and union, as well as provincial government staff, have been working on a Transition Adjustment Committee to assist employees in managing the termination of their employment when the mine closes. Meanwhile, the company is working intensively on reclamation and closure issues associated with the site.

CanZinco Ltd.–Caribou Mine Division (formerly East West Caribou Mining Limited)

Restigouche and Caribou Mines

COMPANY CanZinco Ltd., owned by Breakwater Resources Limited. The head office is 95 Wellington Street West, Suite 2000, Toronto, Ontario, M5J 2N7. The Chairman and CEO is Gordon F. Bub. Telephone: (416) 363-4798. The local address is P.O. Box 26, Bathurst, New Brunswick E2A 3Z1. Telephone: (506) 546-1999. The President and Chief Operating Officer of CanZinco Ltd. is Colin Benner, the General Manager of Caribou Mine is John McCombe.

RIGHTS In 1998, CanZinco Ltd., a wholly owned subsidiary of Breakwater Resources Ltd. held a block of 43 claims (*Mining Act*, Chapter M-14.1, S.N.B. 1985) and Mining Lease 255. In 1997, the company converted 6 of the former 49 claims to form the Mining Lease.

LOCATION The Restigouche Zn, Pb, Ag, Cu deposit (Figure 9: 2a) is on the Road to Resources (Highway 180), about 80 km west of Bathurst in Restigouche County. (Lat. 47° 30.2' N; Long. 66° 33.5' W; NTS 21O/7, 10). The Caribou mine (Figure 9: 2b) is also on the Road to Resources, about 50 km from Bathurst (Lat. 47° 33' N; Long. 66° 17.6' W; NTS 21O/9).

HISTORY (Early history is described in Miscellaneous Report 13, "New Brunswick's Mineral Industry, 1993.")

Marshall Minerals Corp. acquired the property rights from Placer Dome Inc. in March 1988. Results of an extensive drilling program to further define reserves and processability of the ore proved favourable and, in February 1989, Marshall registered under the Province's Environmental Impact Assessment (EIA) Regulation. The project was subsequently screened in because the deposit is situated on Charlotte Brook, which flows into Upsalquitch Lake, a well-known sport fishing area in a relatively undisturbed part of the province. The company completed its EIA report and in August 1990 received a positive response from the Lieutenant-Governor-in-Council to its proposal to proceed with project development. A security of $1 600 000 was required to ensure the environmental integrity of the operation.

Marshall proceeded no further than the EIA approval in its acquisition of required government approvals. Although delays associated with the EIA process, the sharp downturn in zinc prices, and the closure of the Caribou operation motivated the company to put the deposit up for sale, the company later renewed its interest in the deposit. In 1993 with federal/provincial funding, Marshall continued metallurgical studies on the ore and initiated environmental and pit design studies.

In 1995, Breakwater Resources Ltd., owner of the nearby Caribou mine, announced a metallurgical breakthrough that would enable the company to consider reopening the Caribou mine. Following a positive feasibility study and testing of Restigouche ore, Breakwater reached an agreement to purchase the Restigouche deposit from Marshall, with the intention of shipping Restigouche ore to the Caribou mill for processing. In 1996, Breakwater Resources, through its subsidiary East West Caribou Mining Ltd., received regulatory approval to mine the Restigouche deposit. Mining of the deposit began in the spring of 1997.

GEOLOGY The deposit occurs within the Middle Ordovician Mount Brittain Formation at the contact between feldspar-crystal poor (footwall) and feldspar-crystal rich (hanging wall) felsic volcanic rocks. The orebody is elongate in form and plunges to the northwest at 15–20°, oblique to the northeast structural trend. It is 490 m long and averages 90 m wide and 30 m thick. The deposit consists of two separate, stratabound, massive sulphide lenses that coalesce in the central part of the orebody. The sulphides comprise, in order of abundance, pyrite, sphalerite, galena, and chalcopyrite and have been traced to a vertical depth of 183 m to the north. Two northwest-trending diabase dykes transect the Restigouche deposit and are parallel to faults that exhibit minor offset.

EMPLOYEES Eleven people remain on site, two at Restigouche and the remainder at Caribou.

RESERVES Marshall Minerals Corp. reported total reserves of 1 730 000 t grading 0.35% Cu, 5.36% Pb, 6.94% Zn, 112.1 g/t Ag, and 1.2 g/t Au. This includes 1 150 000 t of open pit reserves grading 0.38% Cu, 5.96% Pb, 7.71% Zn, 124.1 g/t Ag, and 1.37 g/t Au using a 6% combined lead–zinc cutoff.

PRODUCTION The two operations have a combined production rate of 3000 t/d (1650 t/d for Caribou and 1350 t/d for Restigouche).

STATUS The operation continued to be suspended.

DEVELOPMENTS As part of the new operating plan, the Caribou concentrator was extensively modified and expanded. It was redesigned to produce separate zinc and lead concentrates, rather than a bulk concentrate as was the case when it last operated (in 1990). Surface preparation of the Restigouche open pit began in the fall of 1996. The first ore was produced in the spring of 1997. All ore from the Restigouche site was trucked to the Caribou mine site (Figure 7:2b) for processing. Notable efforts have been made to protect the sensitive local environment.

Falling metal prices and metallurgical difficulties encountered in processing the combined Caribou and Restigouche mine ores caused a suspension of operations at both mines in August 1998.

ADEX Mining Inc.

(Mount Pleasant Mine)

COMPANY ADEX Mining Inc. has its head office at 172 King St. E., Suite 810, P.O. Box 13, Toronto, Ontario M5A 1J3. Telephone: (416) 947-1179. Local address: P.O. Box 150, St. George, New Brunswick E0G 2Y0. The Chairman and Chief Executive Officer is William.B. Burton.

RIGHTS In 1998, ADEX Mining Corporation held 102 claims (4 claims covering the mine area and 98 claims surrounding the mine area) under the *Mining Act*, Chapter M-14.1, S.N.B. 1985.

LOCATION The Mount Pleasant Sn, In, W, Mo, Zn, Cu, Bi property (Figure 9: 3) is about 50 km northeast of St. Stephen, Charlotte County, New Brunswick (NTS 21 G/7W).

HISTORY (Early history is described in Miscellaneous Report 13, "New Brunswick's Mineral Industry, 1993.")

In December 1993, Piskahegan Resources Limited purchased the Mount Pleasant mine property from LAC Minerals Ltd. and Billiton Metals Canada Ltd. In 1994, ADEX Mining Corporation agreed to fund exploration and metallurgical work in the amount of $525 000, with the aim of earning the right to acquire a 50.1% interest in Piskahegan Resources Limited. On May 1, 1995, ADEX Mining Corporation acquired 100% of Piskahegan Resources Limited for $9 300 000 in cash and shares. Meanwhile, exploration and metallurgical testing continued while the company attempted to secure financing commitments. In November 1995, the name of the company was changed to ADEX Mining Inc.

In April 1996, ADEX Mining Inc. announced it had secured a financing commitment from the Malaysian Smelting Corp. (MSC), under which MSC would have the right to acquire up to 51% of ADEX for $28 000 000. The bulk of the investment was conditional on the delivery of a positive feasibility study for the development of the Mount Pleasant mine. Of the total investment, $2 000 000 was earmarked for the preparation of the study. In 1997 ADEX received a consultant's feasibility study. The conclusions were disappointing, as the estimated capital costs were too high to justify a production decision at that time.

RESERVES (Source: ADEX Mining Corporation, Summary Prefeasibility Report, Oct. 1995)

Zone	Description	Category	Tonnage (t)	Grade						
				Sn (%)	Zn (%)	Bi (%)	In (g/t)	Cu (%)	MoS_2 (%)	WO_3 (%)
North	Endo & Contact	Proven	2 774 000	0.9	0.34	0.08	46.88	0.14	0.06	0.13
	Zones (u/g)	Probable	60 000	0.92	0.34	0.08	46.88	0.14	0.06	0.13
	Possible	200 000	1.15	0.34	0.08	46.88	0.14	0.06	0.13	
North	Deep tin (u/g)	Probable	2 140 000	0.6	0.8	0.06	121.19	0.12	0.05	0.08
North	Tin lodes (o/p)	Probable	2 000 000	0.2	0.96	—	125	0.1	—	—
North	W–Mo–Bi (u/g)	Possible	11 500 000	0.11	0.33	0.08	31.25	0.05	0.09	0.24
Saddle	Tin deposit (u/g)	Possible	2 000 000	0.92	0.34	0.08	46.88	0.14	0.06	0.13
Fire Tower	W–Mo–Bi (u/g)	Proven	9 000 000	0	0.08	0.1	31.25	0.05	0.2	0.4
Fire Tower N	Tin deposit (u/g)	Possible	250 000	0.19	2.24	0.13	206.25	0.14	0.2	0.28
Halo	(u/g and o/p)	Possible	15 000 000	—	1.5	—	109.38	—	—	—

Notes: 1 oz./ton equals 31.0025 g/t; u/g (underground); o/p (open pit)

The company's positive prefeasibility study was based on proven and probable reserves of 5 100 000 t grading 0.77% tin, 2.3 oz./ton indium, 0.5% zinc and 0.12% copper.

PRODUCTION None since 1985.

STATUS The operation continues to be suspended.

EMPLOYEES During 1997, security staff and a small number of professional staff were on site.

DEVELOPMENTS At year's end (1998), the property remained under care and maintenance.

APOCAN Inc.
(Lake George Mine)

COMPANY APOCAN Inc. The mine address is R.R. 1, Prince William, New Brunswick E0H 1S0. Telephone is (506) 366-2885. The Mine Manager is Wayne Marshall.

RIGHTS In 1998, APOCAN Inc. held Mining Lease 250 under the *Mining Act*, Chapter M-14.1, S.N.B. 1985.

LOCATION The Lake George antimony mine (Figure 9: 4) is approximately 15 km north of Harvey Station and 40 km west-southwest of Fredericton, York County (NTS 21 G/14E).

HISTORY (Early history is described in Miscellaneous Report 19, "New Brunswick's Mineral Industry, 1994.")

In 1987, Landmark Corporation (formerly Durham Resources Inc.) sold the property to Dominion Explorers Inc., one of its subsidiary companies. The low price of antimony concentrate, the unfavourable exchange rate for the Canadian dollar, and low ore reserves forced Dominion Explorers Inc. to reduce annual operating costs as much as 12% in an attempt to remain viable. A work-sharing program was negotiated with the Federal government but was not fully implemented. The operation continued through 1989 but was shut down permanently on January 19, 1990.

Following the closure of the mine, the property was purchased by APOCAN Inc.; Mining Lease 250 was transferred to the company in February, 1990. As a result of sharply higher antimony prices in the second half of 1994, APOCAN decided to resume operations at the Lake George mine. A Certificate of Approval to dewater the underground workings was issued in October, 1994 and in December work began on the installation of a new hoist.

Mine production officially resumed in July 1996. Production targets were reached or exceeded, but problems with the hoist caused a shutdown in December of the same year. The shutdown was prolonged by a sharp drop in the antimony price. Despite hopes that the price would recover sufficiently to allow a resumption of operations, high metal inventories in global markets continue to depress the price.

RESERVES Proven, probable and possible ore reserves: 262 000 t of ore grading 3.45% Sb.

STATUS The operation continues to be suspended.

DEVELOPMENTS At year's end (1998), the mine continued to be under care and maintenance.

Murray Brook Resources Incorporated
(a wholly owned subsidiary of NovaGold Resources Inc.)
(Murray Brook Mine)

COMPANY The Murray Brook gold, copper, zinc, lead deposit is owned and operated by Murray Brook Resources Incorporated, whose parent company is NovaGold Resources Inc. The head office for NovaGold Resources Inc. is: 3 Spectacle Lake Drive, Suite 300, Dartmouth, Nova Scotia, B3B 1W8. Telephone: (902)468-9270. The Chairman and Chief Executive Officer is Gerald J. McConnell; the President and Chief Operating Officer is Rick van Nieuwenhuyse; the Vice-President of Canadian Operations is William L. Young.

RIGHTS In 1998, Murray Brook Resources Incorporated held Mining Lease 252 under the *Mining Act*, Chapter M-14.1, S.N.B. 1985.

LOCATION The Murray Brook deposit (Figure 9: 5) is approximately 80 km west-southwest of Bathurst in Restigouche County (Lat. 47° 31.5' ; Long. 66° 25.8' ; NTS 21 O/9W). It is accessible via Highway 180 and a newly built access road.

HISTORY (Early history is described in Miscellaneous Report 13, "New Brunswick's Mineral Industry, 1993.")

Murray Brook Resources Inc. successfully completed the mining and vat-leach (indoor) processing of the gold-bearing gossan in early 1992. Known for its innovative extraction methods, the company began mining the underlying copper zone in late 1992, with the intention of extracting the metal using a bio-assisted, sulphuric acid, heap-leach (outdoor) method. Due to unforeseen delays, the project missed the seasonal window for this process and startup was delayed. The agreement that NovaGold Resources signed with Arimetco International Inc. and Breakwater Resources Ltd. to further develop the copper zone of the Murray Brook mine expired with neither company exercising its option.

GEOLOGY The Murray Brook deposit occurs within fine-grained sedimentary rocks that conformably underlie feldspar-phyric tuff of the Middle Ordovician Mount Brittain Formation and gradationally overlie quartz wacke and slate of the Miramichi Group. Previously, these sedimentary rocks were assigned to the Patrick Brook Formation, part of the Miramichi Group, but since the discovery of thin interbedded tuff layers, they are now included in the Mount Brittain Formation. The latter is structurally overlain by mafic volcanic rocks of the Boucher Brook Formation.

The deposit, which prior to mining was capped by a thick gossan, dips moderately to the northwest, plunges gently to the northeast, and appears to pinch out in that direction. It is surrounded by a 1–3 m-wide halo of chloritized sedimentary rocks containing disseminated pyrite. The massive sulphides comprise pyrite, sphalerite, chalcopyrite, galena, and arsenopyrite, in decreasing order of abundance and are divisible into copper, pyrite and lead–zinc zones. The copper zone occurs along the footwall and hanging-wall contacts and is generally separated from the lead–zinc zone by a zone of massive pyrite containing minor amounts of the other sulphides.

EMPLOYEES There were no permanent employees at the mine site in 1998.

RESERVES Geological reserves of the copper zone are 596 000 t grading 2.81% Cu.

PRODUCTION During the three years the mine operated (1989–1992), 1 413 155 g (45,434 oz.) of gold and 10 776 kg (346,457 oz.) of silver were produced.

STATUS The operation is in the final closure stage.

DEVELOPMENTS The Murray Brook mine site is being prepared for final closure. Under the impact of a substantially lower copper price, the company decided in 1998 not to proceed with further mining at Murray Brook, despite some initially encouraging results from exploration drilling at the site. During the year, the company completed a UTEM survey and drilled 14 holes on its Murray Brook deposit. The object of the drilling was to test the down-plunge extent of the known Cu zone and to determine if the deposit has a significant Pb–Zn zone prior to reclaiming the open pit. Modelling of the data from previously drilled vertical holes, using a commercially available 3-D software package, showed that the deposit was virtually untested toward the northwest, in the F_2 down-plunge direction. The drilling confirmed that the deposit does continue to the northwest. The best reported Cu intersection was in hole MB-98-3, which contained 13.6 m grading 4.35% Cu, including 7.0 m grading 7.29% Cu. The best reported lead–zinc intersection was in hole MB-98-5A, which contained 20.2 m grading 2.08% Pb, 6.07% Zn and 73.66 g/t Ag. Some reclamation work was done during the year, including the placement of the remaining stockpiled copper ore in the pit. Further reclamation work remains to be done and is currently under discussion between the company and provincial regulators.

INDUSTRIAL MINERALS

New Brunswick's industrial minerals sector consists of the following ten commodities: peat, potash, salt, limestone, dolomite, marl, silica, dimension stone, crushed stone, and sand and gravel. Several of these are exported to markets throughout the world. The recent closure of one of the Province's two potash mining operations has resulted in a significant decline in the value of potash production. Despite the impact of this loss, the preliminary value of industrial mineral production in 1998 (nonmetals and structural materials, Table 5) was a reputable $226 606 702 or 27 % to the total value of New Brunswick's mineral production.

Peat

Nineteen peat companies were active in the Province in 1998. Most of the development is concentrated in northeastern New Brunswick, mainly in the Acadian Peninsula of Gloucester County west of Bathurst, and in the Baie-Ste-Anne region of Northumberland and Kent counties to the east and southeast of Miramichi (Figure 9). About 85% of the 4300 ha currently opened for production are located on Crown lands.

Peat production in 1998 totalled 10 725 000 bales, a slight increase compared to the preceding year, which was characterized by unfavourable weather conditions. Shipments reached 10 500 000 bales, a drop of 5% with respect to 1997. In June, inventories stood at 1 800 000 bales; in December that number was 3 700 000 bales. The trend toward using large packaging sizes continued with 46% of the peat moss shipped in sizes larger than the traditional 170 dm^3 bag.

The United States continues to be the principal export market for New Brunswick peat producers. In 1998, about 6 000 000 bales were shipped to the USA and 2 000 000 bales were distributed in Canada. The Japanese market continued to favor peat of Canadian origin and accounted for 20% of New Brunswick's exports.

There is a total of 31 Crown peat leases covering 33 peatlands; 29 peat leases were in production. Four additional operations are located entirely on private land.

ASB Greenworld Ltd.

COMPANY ASB Greenworld Ltd., 200, chemin Daigle, Pointe-Sapin (Nouveau-Brunswick) E9A 1T6. Telephone: (506) 876-3937. The Manager is Camille-Ernest Daigle.

RIGHTS ASB Greenworld Ltd. holds Peat Lease No. 19 (627 ha – Peatland 324E) under the *Quarriable Substances Act*, Chapter Q-1.1, S.N.B. 1991.

LOCATION Peatland 324E is in Pointe-Sapin, Kent County (Figure 9: 6).

HISTORY The company began site preparation in 1978. A peat lease was issued in 1982. In 1997, a plastic bag extruding and printing facility was added to the existing infrastructure.

PRODUCTION The company produces milled peat and peat–soil growing mixes.

DEVELOPMENT The company continued to work toward the development of new peat-based growing mixes.

EMPLOYEES In 1998, 15 to 55 persons.

Beausejour Peat Moss Inc.

COMPANY Beausejour Peat Moss Inc., R.R. #1, boîte 58, Shédiac (Nouveau-Brunswick) E0A 3G0. The President is Paul-Émile Leger. Telephone: (506) 532-1172.

RIGHTS The company holds Peat Lease No. 37 (167 ha – Peatland 76) under the *Quarriable Substances Act*, Chapter Q-1.1 S.N.B. 1991.

LOCATION This bog is approximately 5 km southeast of Shédiac, Westmorland County (Figure 9: 7).

HISTORY In 1991, Beausejour Peat Moss Inc. applied for a Peat Exploration Licence for portions of Peatland 76 held by the Crown. During the same year, the company acquired freehold land in the northeastern sector of Peatland 76. In 1992, the licence application was dropped in favour of an Option. Peat extraction began on freehold land. In 1993, the company applied for and received a Peat Exploration Licence. A Peat Lease was issued for the Crown portion of the bog in 1994.

PRODUCTION The company produces milled peat and peat-based compost products.

DEVELOPMENT Development of the production area continued.

EMPLOYEES In 1998, 2 to 24 persons.

La Cie de Tourbe Fafard Ltée

COMPANY La Cie de Tourbe Fafard Ltée / Fafard Peat Moss Co. Ltd., 422, chemin Pallot, Inkerman (Nouveau-Brunswick) E8P 1B5. Telephone: (506) 336-9715. The Manager is Denis Mallet.

RIGHTS La Cie de Tourbe Fafard Ltée holds Peat Lease Nos. 4 (218 ha – Peatland 530), 5(505 ha – Peatland 532), 6 (607 ha – Peatland 529), 22 (206 ha – Peatland 353), 25 (393 ha – Peatland 41) and 34 (398 ha – Peatland 40) under the *Quarriable Substances Act*, Chapter Q-1.1, S.N.B. 1991.

LOCATION Peatland 530 is off Route 113 at Inkerman, Peatland 532 is 15 km south of Shippagan and Peatland 529 is 8 km southwest of Shippagan, all in Gloucester County (Figure 9: 8); Peatlands 40 and 41 are located near Birch Ridge, Kent County (Figure 9: 8a); Peatland 353 is located 3 km southwest of Burnt Church, Northumberland County (Figure 9: 8b).

HISTORY La Cie de Tourbe Fafard Ltée began operations in New Brunswick in 1942 by opening a bog near Shippagan (Peatland 530). New plants were opened in 1955 at Inkerman (Peatland 532) and in 1960 at Évangéline (Peatland 529). Initial production was block-cut peat but by 1973 the entire operation had changed to the production of milled peat. Since 1985, the production of peat mixes has become an important aspect of the New Brunswick operation. A perlite–vermiculite processing plant and a new peat-based growing mix plant were built at Peatland 532 in 1989.

In 1987, Fafard Peat Moss Co. Ltd. acquired the operation of Les Équipements Tardif Inc. on Peatland 41 (Division Kent). Production from Peatland 41 had begun in 1984. In 1991, a peat lease was issued for adjacent Peatland 40.

In 1988, Fafard Peat Moss Co. Ltd. acquired the assets of Burnt Church Peat Moss Co. Ltd. (Peatland 353 - Division Burnt Church). Production from the site began in 1991. A bagging plant was constructed in 1995.

PRODUCTION The company produces milled peat. Peat-based growing mixes are manufactured at the Inkerman plant (Peatland 532).

DEVELOPMENT Continued development of production fields at Burnt Church and Kent mine sites. Peatland restoration work is being done on abandoned parcels of land at the Évangéline site in cooperation with a Université Laval research group headed by Dr. Line Rochefort. In 1998, the company completed a major corporate restructuring plan. Conrad Fafard, Inc. became a major shareholder of Québec-based Les Produits Horticoles Fafard ltée, which previously had controlling interest in la Compagnie de Tourbe Fafard ltée. A new company and wholly owned subsidiary of Conrad Fafard, Inc. named Fafard Products, Inc. was created, with head office in Inkerman, New Brunswick. That holding company is also majority shareholder of Compagnie de Tourbe Fafard ltée.

EMPLOYEES In 1998, 11 to 183 for the combined operations.

Les Entreprises Jean-Eudes Martin et Fils Ltée

COMPANY Les Entreprises Jean-Eudes Martin et Fils Ltée, 4092, boul. des Fondateurs, Saint-Isidore (Nouveau-Brunswick) E8M 1G3. The President is Sylvie Martin. Telephone: (506) 358-9800.

RIGHTS The company operates on its own land.

LOCATION Peatland 541 is located in Tracadie-Sheila, Gloucester County, along Highway 11 (Figure 9: 9).

HISTORY The project was registered with the Department of the Environment early in 1997 and received approval in June 1997. Production of peat began in 1997.

PRODUCTION The company produces milled peat and sells it unprocessed, in bulk.

DEVELOPMENT The company continued to develop its production area.

EMPLOYEES In 1998, 0 to 3 persons.

Good Earth Canada Ltd.

COMPANY Good Earth Canada Ltd., 5960 Broadway, Lancaster, N.Y. 14086, United States of America. Telephone: (716) 684-8111. The President is Guenther Burkhardt.

RIGHTS Good Earth Canada Ltd. holds Peat Lease No. 30 (734 ha – Peatland 338) under the *Quarriable Substances Act*, Chapter Q-1.1, S.N.B. 1991.

LOCATION Peatland 338 is in Escuminac, 50 km east of Miramichi, Northumberland County (Figure 9: 10).

HISTORY The company was issued a peat lease in 1986 following the cancellation of Peat Lease No. 21 (Gulf Peat Co. Ltd.) in January 1986. Production began in 1987.

PRODUCTION The company produces milled peat and peat-based growing mixes.

DEVELOPMENT No new development to report.

EMPLOYEES In 1998, 2 to 27 persons.

Grande Anse Peat Moss Co. Ltd.

COMPANY Grande Anse Peat Moss Co. Ltd., C.P. 90, 70, avenue de la Tourbe, Grande-Anse (Nouveau-Brunswick) E8N 2T9. Telephone: (506) 732-2854. The Manager is Patricia Whelton.

RIGHTS Grande Anse Peat Moss Co. Ltd. holds Peat Lease No. 8 (166 ha) on Peatland 561, under the *Quarriable Substances Act*, Chapter Q-1.1, S.N.B. 1991.

LOCATION Peatland 561 is in the village of Grande-Anse, Gloucester County (Figure 9: 11).

HISTORY The company started a manual block-cut operation in 1961, which was mechanized in 1966. The conversion to a milled peat operation began in 1977.

PRODUCTION The company produces milled peat and minor quantities of block-cut peat.

DEVELOPMENT No new development to report.

EMPLOYEES In 1998, 8 to 34 persons.

Le Groupe Berger ltée

COMPANY Le Groupe Berger ltée, 121, R.R. #1, St-Modeste (Québec) G0L 3W0. The President is Claudin Berger. Telephone: (418) 862-4462. The Manager is Yves Gauthier.

RIGHTS Le Groupe Berger ltée holds Peat Leases No. 29 (603 ha – Peatland 337) and No.33 (159 ha – Peatland 354) under the *Quarriable Substances Act*, Chapter Q-1.1, S.N.B. 1991.

LOCATION Peatland 337 is 2 km north of St-Camille and Peatland 354 is 35 km southwest of Bay du Vin, both in Northumberland County (Figure 9: 12).

HISTORY In 1985, Le Groupe Berger ltée acquired a Peat Exploration Licence that was converted to Peat Lease No. 29 in 1986. Production on Peatland 337 began in 1987. In 1988, Le Groupe Berger ltée applied for and received a Peat Exploration Licence for Peatland 354. Peat Lease No. 33 was issued in 1991. Production from Peatland 354 began in 1992. On December 31, 1996, Berger Inc. transferred all of its assets to Le Groupe Berger ltée, a federally chartered company.

PRODUCTION The company produces milled peat.

DEVELOPMENT The company continued to expand its production fields on both peatlands. A perlite expanding facility was constructed at the St-Camille site.

EMPLOYEES In 1998, 29 to 133 persons.

Le Groupe Qualité Lamèque ltée

COMPANY Le Groupe Qualité Lamèque ltée / Lameque Quality Group Ltd., 36, rue de la Tourbe, Lamèque (Nouveau-Brunswick) E8T 1A3. Telephone: (506) 344-2293. The President is Florent Chiasson.

RIGHTS Le Groupe Qualité Lamèque ltée holds Peat Lease Nos. 7 (202 ha – Peatland 600), 14 (142 ha – Peatland 580), 16 (413 ha – Peatlands 516 and 517), 17 (115 ha – Peatland 576) and 28 (104 ha – Peatland 578) under the *Quarriable Substances Act*, Chapter Q-1.1, S.N.B. 1991.

LOCATION Peatlands 580 and 578 are 4 km north of Lamèque (Figure 9: 13a) and Peatland 576 is 4 km east of Haut-Lamèque (Figure 9: 13b), Gloucester County; Peatlands 516 and 517 are 1.5 km east of Rivière-du-Portage, Northumberland County (Figure 9: 13c); and Peatland 600 is on Pokesudie Island, Gloucester County (Figure 9: 13d).

HISTORY Established in 1971, La Tourbière de Lamèque Ltée became a division of Le Groupe Qualité Lamèque ltée (La Tourbière de Lamèque / Lameque Peat Moss) in 1989. Production on Peatland 578 began in 1989. In 1993, a fire destroyed the main processing plant in Lamèque. The plant became operational again during the summer of 1994.

Production on Peatland 576 began in 1980. La Tourbière de St-Raphaël Ltée became a division of Le Groupe Qualité Lamèque ltée (La Tourbière de St-Raphaël / St. Raphaël Peat Moss Ltd.) in 1989.

Portage Peat Moss Ltd. had started commercial production from Peatlands 516 and 517 in 1972. In 1985, Les Produits Canadien Suprême Ltée, a former affiliated company of Le Groupe Qualité Lamèque ltée, acquired the operation. The operation is now a division of Le Groupe Qualité Lamèque ltée (Les Produits Canadien Suprême / Canadian Supreme Products Ltd.). In 1989, the company suspended operations. A resource evaluation survey was completed in 1990. In 1991, production resumed in selected areas; the peat is trucked to the Lamèque facility for blending and processing.

In 1960, a peat lease was granted to Bushland Products Limited and in 1967 was transferred to Atkins & Durbrow (N.B.) Ltd. Following a disastrous fire in 1978, the plant was rebuilt and production resumed in late 1980. La Tourbière de Pokesudie Ltée / Pokesudie Peat Moss Ltd., a former subsidiary company of Le Groupe Qualité Lamèque ltée, acquired the property in 1988. The company became a division of Le Groupe Qualité Lamèque ltée (La Tourbière de Pokesudie / Pokesudie Peat Moss) in 1989.

PRODUCTION The company produces milled peat and growing mixes.

DEVELOPMENT Expansion of production area and increasing activity level at the Rivière-du-Portage site.

EMPLOYEES In 1998, 21 to 123 persons.

Heveco Ltd.

COMPANY Heveco Ltd., 4534, Route 11, Tabusintac, (Nouveau-Brunswick) E9H 1J4. Telephone: (506) 779-9277. The Manager is Rolf Mecking.

RIGHTS Heveco Ltd. holds Peat Leases No. 9 (1080 ha – Peatland 524) and No. 24 (174 ha – Peatland 522) under the *Quarriable Substances Act*, Chapter Q-1.1, S.N.B. 1991.

LOCATION Peatland 524 is 2 km southeast of Tabusintac and Peatland 522 is located 2 km east of Brantville, Northumberland County (Figure 9: 14).

HISTORY Incorporated in 1962, the company is the only major Canadian producer of block-cut peat. Since 1981, it also has produced milled peat. Production on Peatland 522 began in 1989. The plant was extensively modernized in 1995.

PRODUCTION The company produces block-cut peat, milled peat, and peat-based growing mixes.

DEVELOPMENT Some block-cut fields have been resurfaced to accommodate the milled peat operation. Opening of new production areas continued.

EMPLOYEES In 1998, 22 to 95 persons.

Malpec Peat Moss Ltd.

COMPANY Malpec Peat Moss Ltd., C.P. 118, Rexton (Nouveau-Brunswick) E0A 2L0. Telephone: (506) 523-9161. The Manager is Joe Curry.

RIGHTS Malpec Peat Moss Ltd. holds Peat Lease No. 20 (499 ha – Peatland 213) under the *Quarriable Substances Act*, Chapter Q-1.1, S.N.B. 1991.

LOCATION Peatland 213 is 3 km west of Rexton, Kent County (Figure 9: 15).

HISTORY The company is affiliated with Southern Importers, Inc., Greensboro, North Carolina, United States of America. It was issued a peat lease in 1982 and began production of milled peat in 1985. In 1995, the lease was expanded by about 250 ha. In the spring of 1997, a fire destroyed the bagging plant.

PRODUCTION The company produces milled peat.

DEVELOPMENT Production resumed after a disastrous fire destroyed the bagging plant in 1997. Field preparation in the northern part of the lease.

EMPLOYEES In 1998, 8 to 83 persons.

La Mousse Acadienne (1979) ltée

COMPANY La Mousse Acadienne (1979) ltée / Acadian Peat Moss (1979) Ltd., C.P. 2002, Lamèque (Nouveau-Brunswick) E8T 3N3. Telephone: (506) 344-2225. The President is Gilles Haché.

RIGHTS La Mousse Acadienne (1979) ltée holds Peat Lease No. 13 (232 ha – Peatland 568) under the *Quarriable Substances Act*, Chapter Q-1.1, S.N.B. 1991. Three affiliated companies also hold peat leases: La Tourbe Chiasson Ltée / Chiasson Peat Moss Ltd. (Peat Lease No. 23, 76 ha, Peatland 567); Tourbière Miramichi Ltée / Miramichi Peat Ltd. (Peat Lease No. 31, 770 ha, Peatland 3); and La Tourbière Rivière de l'Anguille Ltée / Eel River Peat Moss Ltd. (Peat Lease No. 36, 580 ha, Peatland 301).

LOCATION Peatland 568 is adjacent to the Coteau Road on Lamèque Island, Gloucester County (Figure 9: 16a); Peatland 567 is 3 km southeast of Petit-Shippagan, Gloucester County (Figure 9: 16b); Peatland 3 is 6 km northeast of St.Margarets, Northumberland County (Figure 9: 16c), and Peatland 301 is 8 km southwest of Eel River Bridge, Northumberland County (Figure 9: 16d).

HISTORY Established in 1965, the company began production on Peatland 568 in 1966. Peat Lease No. 23 was obtained in 1982. Before 1987, all the production from Peatland 567 was processed at the facilities of La Mousse Acadienne (1979) ltée. A bagging plant was installed on Peatland 567 in 1987. Peat Lease No. 31 was obtained in 1988 and production from Peatland 3 began in 1989. Peat Lease No. 36 was obtained in 1994.

PRODUCTION The company and its affiliates produce milled peat.

DEVELOPMENT No new development.

EMPLOYEES In 1998, 18 to 116 persons for the four combined operations.

PaSi Peat Inc.

COMPANY PaSi Peat Inc., 4 Edison Street, St. Margarets, New Brunswick E1N 3A1. The contact person is Paul Sippley. Telephone: (506) 773-3102.

RIGHTS The company is operating on its own land.

LOCATION Peatland 324W is south of Eel River Bridge, Northumberland County (Figure 9: 17).

HISTORY The project began in 1998.

PRODUCTION The company will produce milled peat and sell it unprocessed, in bulk.

DEVELOPMENT Development of production fields began.

EMPLOYEES In 1998, 0 to 3 persons.

Premier Horticulture ltée—Division Rogersville

COMPANY A subsidiary of Entreprises Premier CDN Ltée, 1, ave Premier, C.P. 2600, Rivière-du-Loup (Québec) G5R 4C9. The contact person is Michel Vachon, Director of Operations. Telephone: (418) 862-6356.

RIGHTS Peat Lease No. 35 on Peatland 16, under the *Quarriable Substances Act*, Chapter Q-1.1, S.N.B. 1991.

LOCATION Peatland 16 is on Highway 126, 3 km south of Rogersville in Kent County (Figure 9: 18).

HISTORY Entreprises Premier CDN Ltée applied for a Peat Exploration Licence in 1991 and a licence was issued in that same year. In 1992, a Peat Lease was issued to the newly formed subsidiary company. Initial production of peat began in 1994. A bagging plant was constructed in 1995.

PRODUCTION The company produces milled peat.

DEVELOPMENT Development of production fields continued.

EMPLOYEES In 1998, 2 to 37 persons.

Sun Gro Horticulture Canada Ltd.

COMPANY Sun Gro Horticulture Canada Ltd., 124, chemin de la Tourbe, Maisonnette (Nouveau-Brunswick) E8N 1P8. Telephone: (506) 727-3428. The Manager is Clarence Breau.

RIGHTS Sun Gro Horticulture Canada Ltd. holds Peat Lease Nos. 10 (1405 ha – Peatlands 591 and 592) and 12 (396 ha – Peatland 562) under the *Quarriable Substances Act*, Chapter Q-1.1, S.N.B. 1991.

LOCATION Peatlands 591 and 592 are 3 km southeast of Lamèque and Peatland 562 is 6 km west of Maisonnette, all in Gloucester County (Figure 9: 19).

HISTORY In 1964, Western Peat Company Ltd., a Canadian company owned by Red Wing Peat Corporation (USA), established a base of operations at Maisonnette (Peatland 562). In 1970, Red Wing Peat Corporation purchased Atlantic Peat Moss Co. Ltd. at Shippagan (Peatlands 591, 592 and 527). Atlantic Peat Moss Co. Ltd. had produced from Peatland 527 (1953–1971) and from Peatland 591 since 1952.

In 1974, S.B. McLaughlin Associates Limited of Toronto, Ontario, purchased the holdings of the major shareholder, Red Wing Peat Corporation, and assumed control. This was followed by the combination of the business operations of Western Peat Company Ltd. and Atlantic Peat Moss Co. Ltd. into Western Peat Moss Limited.

In 1980, Fisons, a British company, acquired a 50% interest in Western Peat Moss Limited. The joint venture company was renamed Fisons Western Peat Moss Limited and then changed to Fisons Western Corporation in January 1982, when Fisons acquired the remaining McLaughlin interests. Production from Peatland 527 ceased in 1971 due to fire hazard to the town of Shippagan and the site was converted to Peat Lease No. 26 in 1984. The new plant on Lamèque Island (Peatland 591) opened in 1981. The company changed its corporate name to Fisons Horticulture Inc. in 1989.

In 1993, Fisons Horticulture Inc. was acquired by Sun Gro Horticulture Inc. The New Brunswick operation is managed by Sun Gro Horticulture Canada Ltd.

Former Peat Lease No. 26 was terminated in 1994 after appropriate restoration work had been completed.

PRODUCTION The company produces milled peat and peat-based growing mixes.

DEVELOPMENT Continued expansion of production fields on Peatland 591. Peatland restoration work is being done on abandoned parcels of land at the Lamèque site in cooperation with a Université Laval research group headed by Dr. Line Rochefort.

EMPLOYEES In 1998, 43 to 142 persons.

Theriault & Hachey Peat Moss Ltd.

COMPANY Theriault & Hachey Peat Moss Ltd., 201, chemin Theriault-Hachey, Baie-Sainte-Anne (Nouveau-Brunswick) E9A 1N7. Telephone: (506) 228-4530. Elphège Theriault is President. The Chief Executive Officer is Gary Williston.

RIGHTS Theriault & Hachey Peat Moss Ltd. holds Peat Lease No. 11 (330 ha – Peatland 324W) and Peat Lease No. 27 (125 ha – Peatland 302A) under the *Quarriable Substances Act*, Chapter Q-1.1, S.N.B. 1991.

LOCATION Peatland 342W and 302A are 6 km south of Eel River Bridge, Northumberland County (Figure 9: 20).

HISTORY The company was formed in 1963 but block-cut peat had been produced from the site since 1961. In 1977, the block-cutting operation was converted to a milled peat operation. The company acquired a peat lease on Peatland 302A in 1985. Production on Peatland 302A began in 1990.

PRODUCTION The company produces milled peat.

DEVELOPMENT New fields continue to be opened on Peatland 302A.

EMPLOYEES In 1998, 8 to 58 persons.

La Tourbe de Pigeon Hill Ltée

COMPANY La Tourbe de Pigeon Hill Ltée, C.P. 2067, 76 rue du Pêcheur, Lamèque (Nouveau-Brunswick) E8T 3N5. Telephone: (506) 344-5653. The President is Edmond Chiasson.

RIGHTS La Tourbe de Pigeon Hill Ltée holds Peat Lease No. 18 (234 ha – Peatland 569) under the *Quarriable Substances Act*, Chapter Q-1.1, S.N.B. 1991.

LOCATION Peatland 569 is in Pigeon Hill on Lamèque Island, Gloucester County (Figure 9: 21).

HISTORY A peat lease was issued in 1979.

PRODUCTION The company produces milled peat.

DEVELOPMENT Continued expansion of production fields.

EMPLOYEES In 1998, 2 to 22 persons.

La Tourbière de Petit-Shippagan

COMPANY La Tourbière de Petit-Shippagan, C.P. 2130, Lamèque (Nouveau-Brunswick) E8T 3N7. The contact person is François-Robert David, Director of Operations. Telephone (506) 344-8064.

RIGHTS The company is operating on its own land.

LOCATION Peatland 579 is 7 km northeast of Lamèque, on the road to the Miscou bridge, Gloucester County (Figure 9: 22).

HISTORY The project was registered with the Department of the Environment early in 1993 and received approval in July 1993. Production of peat began in 1994.

PRODUCTION The company produces milled peat and sells it unprocessed, in bulk.

DEVELOPMENT No new development.

EMPLOYEES In 1998, 1 to 6 persons.

La Tourbière du Centre de l'Île Ltée

COMPANY La Tourbière du Centre de l'Île Ltée, 264, rue du Pêcheur Nord, Lamèque (Nouveau-Brunswick) E8T 1K2. The contact person is Pierrette Savoie. Telephone: (506) 344-8236.

RIGHTS The company is operating on its own land.

LOCATION Peatland 580 is in the town of Lamèque, Gloucester County (Figure 9: 23).

HISTORY The project was registered with the Department of the Environment in 1994 and received approval in November 1995. Production of peat began in 1996.

PRODUCTION The company produces milled peat and sells it unprocessed, in bulk.

DEVELOPMENT No new development.

EMPLOYEES In 1998, 0 to 3 persons.

Potash, Salt

Following its discovery in 1971, potash rapidly became a major contributor to the value of industrial mineral production in New Brunswick. In terms of its impact on the total value of minerals produced in the Province, potash remains second only to zinc. Until 1996, New Brunswick potash producers accounted for roughly 10% of Canada's productive capacity and between 10 and 15% of its annual production.

New Brunswick's two world-class potash mining and processing facilities are situated in the southeastern part of the Province near the Town of Sussex.

Potash Corporation of Saskatchewan Inc. (Cassidy Lake Division)
(formerly Potacan Mining Company)

COMPANY Potash Corporation of Saskatchewan Inc. (Cassidy Lake Division) [PCS (Cassidy Lake)], Contact is Raoul Gauthier, General Manager, Potash Corporation of Saskatchewan Inc. (Cassidy Lake

Division). Telephone: (506) 433-5445. Mine address is P.O. Box1489, Sussex, New Brunswick E4E 5L2. Site Superintendant is Wally Farrah. Telephone: (506) 839-2146. Corporate office: Potash Corporation of Saskatchewan Inc., 122 – 1st Avenue S., Suite 500, Saskatoon, Saskatchewan S7K 7G3.

RIGHTS Potash Corporation of Saskatchewan Inc. (Cassidy Lake Division) holds a Potash Agreement (8887 ha), under Section 25(2) of the *Mining Act*, Chapter M-14.1, S.N.B. 1985.

LOCATION The PCS(Cassidy Lake) processing operation (Figure 9: 24) is situated about 20 km southwest of Sussex, Kings County (NTS 21 H/12E).

HISTORY Potash and salt were discovered in the Salt Springs area by the New Brunswick Department of Natural Resources in 1973. Subsequent exploration and development rights to a 120 km^2 reservation area were granted to International Minerals and Chemical Corporation (IMC). Full-scale exploration (22 drill holes) began in 1975, and was successful in confirming a significant orebody. Despite extremely encouraging results from the drilling program, IMC sold the property to Denison Mines Limited of Toronto in the latter part of 1978. Construction of a 5-m-diameter exploration mine shaft was commenced in September, 1979, and reached a target depth of 835 m by 1982.

In December 1980, Denison Mines Limited assigned a 40% interest to Potash Company of Canada Limited (Potacan). Potacan, owned jointly by Entreprise Minière et Chimique, and Kali und Salz AG, handled potash sales while Denison was the overall development manager.

A feasibility study completed in 1982 resulted in a production decision announcement on February 7, 1983. Work on the No. 2 shaft, the production shaft, commenced in 1983, along with continued underground development and the construction of the surface infrastructure related to the mill facility, tailings storage, and brine disposal. By July, 1985, all preproduction work was completed and the first shipment of potash was destined for Colombia on September 17, 1985.

Because of financial difficulties, Denison sold its interest in the property to its Potacan partners in 1991 and the name was subsequently changed to the Potacan Mining Company (PMC).

Throughout most of its 12 years of operation, Potacan generally maintained production levels greater than 75 % of its rated 1 300 000 product tonne capacity and had established itself as the Province's largest potash mining and milling facilty. In the spring of 1997, water inflow occurred in the underground. Following unsuccessful attempts to reduce the flow to a manageble level, PMC's parent company, the Potash Company of Canada, announced the permanent suspension of operations at the Cassidy Lake mine about 6 months later. A plan was implemented to dispose of all surface tailings and carry out remedial site work. This closure reduced the Province's productive capacity by almost two thirds and resulted in the loss of hundreds of jobs.

Early in 1998, the former Potacan operation was purchased by the Potash Corporation of Saskatchewan Inc. The facility, now called *Potash Corporation of Saskatchewan Inc. (Cassidy Lake Division)* utilizes the existing processing facility and related infrastructure to upgrade standard-grade potash imported from company operations in western Canada. The result is a higher-value granular product supplied to markets in eastern Canada and the United States. Both PCS operations in the Sussex area are linked by rail to the port of Saint John, 60–70 km to the west, a critical marketing advantage in the efficient global distribution of this important commodity.

RESERVES AND GRADE Not available

PRODUCTION Potash production commenced in July, 1985. Historically, PMC maintained annual production generally at 75–80% of the operation's annual rated capacity of 1 300 000 product (KCl) tonnes making it New Brunswick's largest potash mine and processing facility. Production ceased in 1997. Approximately 300 000 t of standard grade potash from PCS Saskatchewan operation(s) was compacted to a granular-sized product in 1998.

EMPLOYEES 30 persons in 1998

DEVELOPMENT In March 1998, the Potash Corporation of Saskatchewan Inc. purchased all outstanding shares from Potacan's holding company, the Potash Company of Canada Limited (an equal partnership between Kali und Salz of Germany and Entreprise Minière et Chemique of France). PCS is using the former Potacan mill to upgrade standard product from its Rocanville operation in western Canada into a higher-value granular product (annual granular capacity of 1 000 000 t). A rail car unloading facility was installed to accommodate the efficient offloading of this material.

Potash Corporation of Saskatchewan Inc. (New Brunswick Division)

COMPANY Potash Corporation of Saskatchewan Inc. (New Brunswick Division) [PCS(NB)], P.O. Box5039, Sussex, New Brunswick E4E 5L2. Telephone: (506) 433-5445. The General Manager is Raoul Gauthier. Corporate office: Potash Corporation of Saskatchewan Inc., 122 – 1st Avenue S., Suite 500, Saskatoon, Saskatchewan S7K 7G3.

RIGHTS Potash Corporation of Saskatchewan Inc. (New Brunswick Division) holds a Potash Agreement (19165.5 ha), under Section 25(2) of the *Mining Act*, Chapter M-14.1, S.N.B. 1985.

LOCATION The PCS(NB) mine/mill facility (Figure 9: 25) is on the north side of Highway 2, about 5 km east of Sussex, Kings County (NTS 21 H/11W, 21 H/14W).

HISTORY Following the discovery of potash in the Plumweseep–Penobsquis area by the New Brunswick Department of Natural Resources in 1971, exploration and development rights covering a 360 km^2 reservation area were granted to the Potash Company of America in 1973. After a comprehensive exploration program and feasibility study, the company proceeded with the construction of a 5-m-diameter exploratory mine shaft in the spring of 1978. The exploration shaft was completed in April and underground exploration was completed in October of 1980. On October 27, 1980, the Potash Company of America announced that it was proceeding to production with a mine capacity of 900 000 t/a although initial capacity would be 630 000 t/a.

Mine development, mill construction, and the Courtenay Bay potash shipping terminal in Saint John were completed in 1983. The first potash was produced from the mill on July 17, 1983. The first shipment of potash through the port facility in Saint John took place early in 1984.

After purchasing PCA early in 1986, Rio Algom Limited spent more than $30 000 000 on improvements designed to bring the Sussex mine up to its rated capacity of 635 000 product tonnes per year by April of 1987.

In 1993, the assets of Potash Company of America (a Division of Rio Algom Limited), including the New Brunswick mine and the Saint John port facility, were acquired by Potash Corporation of Saskatchewan Inc.

RESERVES AND GRADE On the basis of geophysics, surface and underground exploration drilling and mine development, PCS(NB) believes the mine has a reserve (proven) life of at least 23 years at current rates of productive capacity (785 000 t of KCl product in 1998: PCS 10-K Form 1998).

PRODUCTION Potash and salt production commenced in 1983. In 1998, an annual potash production record was achieved at 783 000 t KCl, (Potash Corporation of Sakatchewan Inc. 1998: Annual Report, p. 7–8)

PCS(NB) also produces salt in conjunction with its potash operation. Some salt is consumed regionally; however, most is trucked to and exported from the Port of Saint John. The material is sold exclusively to the salt division of Cargill Incorporated. Although production of this mineral commodity has expanded over the last few years, 1998 witnessed a slight decline, reflected in a 32 % reduction in salt shipments (286 000 tonnes in 1997 compared to 192 000 tonnes in 1998) out of the Saint John port facility.

EMPLOYEES Average of 347 persons for 1998.

DEVELOPMENT From a production viewpoint, PCS (NB) had a good year in 1998 running close to full capacity with potash markets remaining relatively stable. Late in the spring, company officials detected a small brine inflow in a section of the mine. Production has been maintained throughout the year without interruption as mine personnel conduct extensive geotechnical studies to pinpoint the inflow's source and recommend appropriate mitigative measures.

Limestone, Dolomite, Marl

The trend of production at New Brunswick's limestone and dolomite operations has increased steadily over the last few years. Between 700 000 and 900 000 t of limestone and dolomitic limestone are processed annually from five operations (Havelock Lime, a Division of Goldcorp Inc. of Havelock; Lafarge Canada Inc. of Havelock; Brookville Manufacturing of Saint John; Elmtree Resources Ltd. near Bathurst and Upper Kent Lime Works, north of Bristol). The industry manufactures a range of chemical and pulverized products featuring agricultural and calcined/hydrated lime, flue gas desulphurization limestone as well as aggregate. In recent years there has been considerable research targeted at developing new value-added lime and limestone product lines.

Brookville Manufacturing Company

COMPANY Brookville Manufacturing Company, P.O. Box 2332, Station C, Saint John, New Brunswick E2L 3V6. Telephone: (506) 633-1200. The General Manager is Malcolm Hoar.

RIGHTS Mineral rights through Original King's Land Grant.

LOCATION Brookville, East Saint John, Saint John County (Figure 9: 26). The quarry and crushing operations are between Highway 1 (Sussex–Saint John Highway) and Highway 100 (Rothesay Highway), approximately 2 km east of their junction. Access to the quarry is via the Rothesay Highway (NTS 21 H/5).

HISTORY This company is the oldest limestone processing facility in New Brunswick, commencing operations over 75 years ago (1920), primarily producing agricultural limestone and aggregate. It has been operating almost continuously since that time.

RESERVES AND GRADE At present market levels, the company estimates adequate reserves of stone for many more years. Although grade varies throughout the quarry, from areas of high-calcium limestone to areas of dolomite, the bulk of production is centred in the more dolomitic areas where grades fluctuate from 40 to 45% $MgCO_3$.

PRODUCTION The company, which quarries and processes 200 000 to 300 000 t of limestone/dolomite each year, produces dolomitic agricultural lime and a wide range of aggregate for construction and related purposes.

EMPLOYEES Average of 22 persons in 1998.

DEVELOPMENT Continued operation.

Lafarge Canada Inc.
(Havelock Quarry and Cement Plant)

COMPANY Lafarge Canada Inc. The plant address is R.R.#1, Havelock, New Brunswick E0A 1W0. Telephone: (506) 534-2301. The Manager is Dave Clark.

RIGHTS Lafarge Canada Inc. holds Mining Lease 245 (632.5 ha), which includes the existing plant and quarries, and Mining Lease under the *Mining Act*, Chapter M-14.1, S.N.B. 1985. The company holds mineral claims near Havelock and Petitcodiac.

LOCATION The limestone quarries and cement plant (Figure 9: 27) are adjacent to Highway 880, about 5 km east of Havelock, Westmorland County (NTS 21 I/3W).

HISTORY Limestone quarries near the plant have been supplying raw material for the manufacture of cement since 1952. After 1982, production of cement from local raw materials was limited to fulfilling market requirements for oil well and other specialty cements. The plant was maintained as a grinding operation for imported Nova Scotia clinker until 1987 when the company closed its cement production facility; however, it continues to quarry stone used for other purposes. The plant property now serves only as a distribution point for products from another company operation in the Maritimes.

The McGee quarry was opened in 1986 just north of Highway 880, less than 1 km east of the plant. This property, partially investigated in 1976, was known to contain extensive reserves of high-calcium limestone. A drilling program was undertaken in 1985 to verify the quality and extent of the deposit prior to the establishment of the new quarry site. Over the last decade, the company has supplied limestone to an unrelated lime plant operating at Havelock.

RESERVES AND GRADE Potential medium- to high-grade limestone (i.e., 50–53% CaO) resource is estimated to be fairly extensive on properties held under Mining Lease by Lafarge Canada Inc.

PRODUCTION Historically, the company has produced up to 400 000 t of limestone annually, primarily for use in cement manufacturing. However, since the closure of its plant, stone quarried for cement production has ceased. Despite the plant closure, Lafarge continued to produce stone from its McGee quarry through 1988. The company has an agreement with Havelock Lime (a division of Goldcorp Inc.) to supply raw stone on a yearly basis. Lafarge Canada Inc. also produces aggregate occasionally for its subsidiary, Lafarge Construction.

EMPLOYEES 4 persons in 1998.

DEVELOPMENT The plant continues to serve as a New Brunswick distribution point for Lafarge cement products produced elsewhere in the Maritimes. Some exploration drilling was undertaken in 1998 on mineral claims at Springhill several kilometres west of the former plant site. A limestone supply agreement is in effect with a lime operation.

Elmtree Resources Ltd.
(Sormany Quarry)

COMPANY Elmtree Resources Ltd., P.O. Box 665, Bathurst, New Brunswick E2A 3Z6. Telephone: (506) 546-6382. The Executive Officer and President is A. Buzas, and the Manager and Vice-President is M. Buzas.

RIGHTS Elmtree Resources Ltd. holds Quarry Lease No. 27 (84.3 ha) under the *Quarriable Substances Act*, Chapter Q-1, R.S.N.B. 1968 as well as Mining Lease 247 (161.1 ha; Armstrong Brook), Mining Lease 248 (171.3 ha; Sormany) and Mining Lease 249 (245.94 ha; Elmtree) under the *Mining Act*, Chapter M-14.1, R.S.N.B. 1986.

LOCATION The Sormany deposit (Figure 9: 28) is about 30 km west of Bathurst, adjacent to the Millstream River (NTS 21 O/9).

HISTORY Although the limestone near Sormany was mapped by J.L. Davies (Geological Surveys Branch) in 1959, it was not until 1982 that Elmtree Resources Ltd. mapped and sampled the deposit in detail. Two holes were drilled to further test the extent and grade continuity of the limestone at depth. Results were encouraging enough for the company to eventually proceed with quarry development and establish an on-site processing facility in the early 1990s.

In 1992, quarry operations shifted from the company's original Elmtree site to another location near Sormany, about 34 km to the southwest. All operations have been consolidated at the Sormany site, with Elmtree's former location near Petit Rocher serving as a storage and distribution point for selected limestone products.

RESERVES AND GRADES Initial exploration (early 1980s) indicated possible reserves in excess of 8 000 000 t of limestone.

PRODUCTION Between 40 000 and 50 000 t of flux-grade material is supplied annually to the nearby smelter at Belledune and flue-gas desulphurization (FGD) agent to two power plants in northern New Brunswick, one at Belledune and the other at Dalhousie. Annual requirements for FGD limestone alone could eventually exceed 175 000 t of >90% $CaCO_3$; however, current production is in the order of 120 000 t.

DEVELOPMENT The existing quarry was expanded to the west in 1998.

EMPLOYEES Average of 14 persons in 1998.

Havelock Lime, a Division of Goldcorp Inc.

COMPANY Havelock Lime, P.O. Box 59, Havelock, New Brunswick E0E 1W0. Telephone: (506) 534-2311. The General Manager is Frank Derrah.

RIGHTS Goldcorp Inc. holds Mining Lease 243 (282.9 ha) and Mining Lease 244 (182.4 ha), under the *Mining Act*, Chapter M-14.1, S.N.B. 1985. Lease 243 includes the operating quarry at Samp Hill and Lease 244 includes the plant. The company also holds several claim blocks in the Havelock, Sussex and Canaan areas.

LOCATION The company operates a quarry at Samp Hill (Figure 9: 29), about 5 km west of Havelock. A processing facility is situated less than 1 km east of the Village (NTS 21H/13W).

HISTORY Havelock Lime, formerly Havelock Lime Works Ltd., has been quarrying in the area since 1938. The original company was incorporated in 1964, and in 1970 a subsidiary company, Havelock Processing Ltd., was formed to manage the manufacturing of quick and hydrated lime. In 1984, Dickenson Mines Ltd. purchased 60% interest in the Havelock group of companies. In 1987, the remaining 40% was acquired.

The construction of a 330 t/d annular-shaft kiln was completed in 1989 in order to improve fuel economy, provide increased production capacity and provide long-term market competitiveness. Some stone is purchased from Lafarge Canada Inc. who operates a nearby quarry. A new 10 ton/hr. hydrator has improved production efficiency. In 1991, a washing plant was commissioned, providing better quality stone feed to the kiln.

In 1996, Havelock Lime's reputation as a marketer of quality lime products was enhanced by its qualification for the internationally recognized ISO 9002 quality assurance accreditation.

RESERVES AND GRADE Limestone requirements are supplied from the company's Samp Hill quarry and up to an additional 400 000 t/a, purchased from the neighbouring Lafarge Canada Inc. quarry under the terms of a recently negotiated multiyear limestone supply agreement. The company reports several million tonnes of proven, probable and possible limestone reserves at its Samphill and other properties in the Havelock area (i.e., near Hicksville and adjacent to the Lafarge cement plant). The company also has access to proven and probable reserves in excess of 10 000 000 t on leased properties in the Havelock area. In its 1997 Annual Report, Goldcorp Inc. indicated that at the current rate of production, Havelock Lime has limestone reserves to last approximately 30 years. Although not fully delineated, total reserves from company holdings in the Havelock area were estimated at 8 300 000 tons (Goldcorp Inc., Annual Report, 1997).

PRODUCTION The company processes between 300 000 and 400 000 t of limestone annually. Chemical process stone (for use as flux in nonferrous smelters, the glass industry, pulp and paper mills, and fibreglass), pulverized stone (for use in dusting mines and for agricultural purposes), poultry grit, and crushed stone (for use as concrete aggregate and for general construction) are currently produced. In 1998, Havelock Lime reported limestone and lime product sales of almost 276 000 t, a 9% increase over 1997. Havelock remains the only source of quick and hydrated lime in the Maritimes.

EMPLOYEES An average of 53 persons in 1998.

DEVELOPMENT The company has been conducting considerable research targeted at developing new value-added lime and limestone product lines. Higher-value new products such as Hydra Lime+ (comprising hydrated lime, gypsum and magnesium limestone) should allow the company to penetrate markets not previously accessible with traditional agricultural lime products. Initiatives are also underway to recognize additional high-quality limestone resources in southern New Brunswick.

Upper Kent Lime Works Ltd.

COMPANY Upper Kent Lime Works Ltd., R.R. 3, Bath, New Brunswick E0J 1E0. Telephone: (506) 278-5359. Contact person is Douglas Lloyd.

RIGHTS Upper Kent Lime Works Ltd. holds Mining Lease 242 (16.2 ha), under the *Mining Act*, Chapter M-14.1, S.N.B. 1985.

LOCATION This marl deposit (Figure 9: 30) is in the bottom of a partially drained lake at Maplehurst, 15 km north of the Village of Bath (NTS 21 J/12).

HISTORY The deposit has been worked since the late 1950s and was acquired by the present owners in 1973.

RESERVES AND GRADE Less than 30 000 t of marl ranging between 85% and 95% $CaCO_3$ remain at this location.

PRODUCTION Marl is extracted from a shallow lake bottom using a dragline, spread on the adjacent hillside to dry, and stockpiled. It is then screened to remove pebbles, twigs, etc., and trucked to local farmers for use on potato fields. The main operating period is late April to June. An additional two- to three-week period of operation typically occurs in the fall to stockpile material. Annual sales vary but are generally less than 2000 t.

EMPLOYEES 3–4 persons (seasonal)

DEVELOPMENT Continued operation.

Silica

Atlantic Silica Inc.

COMPANY Atlantic Silica Inc., 266 Hillsborough Road, Riverview, New Brunswick E1B 4G7. Telephone: (506) 387-4648; Mine site telephone: (506) 433-5890. Fax: (506) 387-3080. President and General Manager is Robert Pickett.

RIGHTS Atlantic Silica Inc. (formerly Sussex Silica Inc.) holds Mining Lease 241 (599.8 ha), under the *Mining Act*, Chapter M-14.1, S.N.B. 1985.

LOCATION This deposit of unconsolidated silica sand and pebbles (Figure 9: 31) is about 16 km southwest of Sussex, immediately northeast of Cassidy Lake (NTS 21 H/12E).

HISTORY The deposit was discovered in 1981. After identifying sufficient reserves of high-quality sand, a pilot plant was set up in 1983 for product testing and marketing. Full-scale production began in 1986. In the fall of 1986, the company mined several thousand tonnes of lump silica and sand of various sizes. The lump silica was used in the manufacture of silicon metal and silicon carbide at Becancour, Québec. The company's assets were acquired in 1993 from Baskatong Quartz Ltd. (Sussex Silica Inc.)

RESERVES AND GRADE The company reports proven reserves of 25 000 000 t of unconsolidated quartz sand and pebbles in association with kaolin. The silica approaches 100 % SiO_2, 0.04–0.15% Fe_2O_3; 0.02% CaO; 0.15% Al_2O_3 and trace amounts of TiO_2.

PRODUCTION Existing capacity of the operation is estimated at 100 t/h.

EMPLOYEES Average of 8 persons in 1998.

DEVELOPMENT The company has marketed several specialty products, including sand blasting material; filtration, tree nursery, and decorative sands; and sands used in the manufacture of glass and fibreglass. In 1998 Atlantic began supplying silica for a Sussex-based manufacturer of agglomerated tiles for interior and exterior floor and wall applications.

Chaleur Silica (a Division of The Shaw Group)

COMPANY Chaleur Silica (an operation of Shaw Resources), P.O. Box 60, Shubenacadie, Nova Scotia B0N 2H0. Telephone: (902) 883-2220. FAX: (902) 758-3622. Contact person is Glen Hardie.

RIGHTS Shaw Group has a 27-acre lease agreement with the landowner.

LOCATION The Bass River silica quarry (Figure 9: 32) is immediately south of Highway 11, approximately 6.5 km east of Bathurst, Gloucester County (NTS 21 P/12E).

HISTORY The property was originally explored by East Coast Smelting and Chemical Company in 1961, but the property remained undeveloped until 1974 when World Wide Explorations opened a small quarry. Purchased by Godin M-E in 1976, the operation was expanded and modernized. It was operated under the name Chaleur Silica Limited until the late 1980s. In 1992, the Shaw Group Limited of Nova Scotia purchased the company, changing the name of the operation to Chaleur Silica.

RESERVES AND GRADE An estimate of reserves is not available for this property. The resource is primarily a quartzose sandstone with an average SiO_2 content of 90%.

PRODUCTION The quarry operates on a seasonal basis. The market depends almost entirely on the sale of silica flux to the Belledune smelter. Annual production is generally between 20 000 and 25 000 t of 0.5 inch minus material.

EMPLOYEES Information is not available but the number is expected to be 2 to 3 seasonal.

DEVELOPMENT Material is excavated at Bass River and crushed and sized in Petit Rocher. Plans are to continue the operation depending on market demand and availability.

Dimension Stone

The New Brunswick dimension stone industry today bears no resemblance to that of former decades. Nonetheless, half a dozen companies still quarry and work stone in the Province, shaping it into monuments, curbing, streetscaping stone, stone for new buildings and restoration material. These companies belong to three categories. The first entails those that use no local stone, but instead obtain rough blocks from out-of-province, then process them within New Brunswick for monumental purposes. The sole member of this category is Brunswick Monuments Ltd. of Grand Falls. Several more companies fall into the second group—those that import finished foreign monuments and engrave them on site—but they are not described here. The third group—those that handle foreign and/or New Brunswick stone—consists of Nelson Monuments Ltd. of Sussex, Smith Cut Stone and Quarries Limited of Shediac, Maritime Stone Works Inc. (formerly Bee Stone Company Inc.) of Scoudouc, and Bastarache Stone Quarrie near Notre Dame.

Brunswick Monuments Ltd.

The address for Brunswick Monuments Ltd. is P.O. Box 353, Grand Falls, New Brunswick E0L 1M0. Telephone: (506) 473-4753.

Roland Cyr owns and operates the only stone finishing works in northern New Brunswick. After apprenticing in the Québec stone industry, he opened his own monument business in 1972 on the Trans-Canada Highway, 8 km west of Grand Falls in New Brunswick (Figure 9: 33). The company imports granite as rough blocks from Québec, Ontario, South Africa, and the United States, and processes them on-site.

The rough stone blocks are slabbed using diamond saws. Some are mechanically polished while others are reduced to monument-sized tablets. Workers prepare the stencils for lettering and decorative work by hand before engraving the monument face beneath a sandblast unit. Monuments are sold to clients across northern New Brunswick and Maine.

Nelson Monuments Ltd.

The address for Nelson Monuments Ltd. is P.O. Box 1220, Sussex, New Brunswick E0E 1P0. Telephone: (506) 433-3413.

Nelson Monuments Ltd.—the largest monumental company in Atlantic Canada—has historic links with one of the earliest monument men in New Brunswick, Josiah Tingley. The Tingley family began producing tombstones at Hopewell Cape in 1846 and steadily expanded over the next seventy years, hiring local people as business grew. In 1907, the Tingleys took on two young brothers named Percy and George Nelson. After two years' apprenticeship, the brothers established their own business two miles down the road at Lower Cape; there, they made monuments of native sandstone, and native and foreign granite.

The Nelson enterprise remained as a small family operation for about forty years until it passed to George's sons Maurice and Russell in the early 1950s. Together, the two men slowly changed the company's entire approach. First, they incorporated into Nelson Monuments Ltd. in 1954. Five years later they moved from Lower Cape to a new stone finishing plant in Sussex and steadily built the business into the vibrant monumental and quarrying concern it is today.

Part of the Nelsons' strategy was to buy or lease quarry properties across New Brunswick. In this, they had variable success. Between 1957 and the early 1970s they obtained quarry rights to several lots at Hampstead. These have since proven viable and currently supply thirty to forty per cent of all stone used at the Sussex plant. Production consists of the pink Hampstead granite (now designated by the trade name *Coral Dawn*), and averages 200–280 m^3 annually.

In 1962, the Nelsons purchased the Spinney quarry in Charlotte County from Ken Fitzgerald, using its black granite as monumental material and as veneer for store fronts in Moncton and the Centennial Building in Fredericton. In the mid- to late 1970s, they reopened quarries at Dawson Mountain (light pink) and Johnson Lake (black), providing stone from the former site to the Saint John Regional Hospital and other building projects. However, the quarries were not commercially feasible and around 1980 Nelson Monuments ceased all activity in the area.

Today, the Nelsons work quarries at Hampstead (Figure 9: 34) and also at Vermillion Bay in northern Ontario. All operations use the flame-jet cutting technology to extract stone whereby diesel fuel and compressed air are combined to produce a very concentrated, high-temperature flame like a blow torch. When applied to rock, the jet causes a narrow section of stone to spall and chip, creating a channel about four inches wide. As well, the quarries feature modern quarry bars, squaring equipment, and front-end loaders. Granite from Hampstead is trucked to the Sussex plant and manufactured into monument bases, streetscaping, curbing, bridge stone, and some veneer stone.

In addition to working stone from Vermillion Bay and Hampstead, the Nelsons import granite from South Africa, India, Norway, Finland and the United States for monumental or decorative purposes. The Sussex plant holds an array of computerized diamond saws, polishing tables and lettering facilities including a computer-assisted drafting machine. In 1998, Nelsons employed about near 30 people at its New Brunswick operations. The company has over two hundred sales representatives. Its monuments are bought by clients in Newfoundland, Nova Scotia, Prince Edward Island, the Gaspé coast, and southern Ontario. Its lettering and distribution plant in Waterloo, Ontario is one of the most modern in Canada.

Maritime Stone Works Inc.

The address for Maritime Stone Works Inc. (formerly Bee Stone Company Inc.) is 100 Brennan Ave., Scoudouc, New Brunswick E0A 1N0. Telephone: (506) 533-9384. The company is owned and managed by Fred Pellerin.

Maritime Stone Works Inc. (formerly Bee Stone Company Inc.) has been operating since the late 1980s, supplying a light buff, beige and brown sandstone for both new construction projects and the restoration market from a quarry in Westmorland County of southern New Brunswick. Stone from this and adjacent quarry sites probably accounted for stone exports in the millions of tons during the late 1880s.

To date, Maritime Stone Works Inc. has fulfilled restoration contracts, providing material from the Boudreau quarry (Figure 9: 35) to repair Monument Lefebvre in St-Joseph and stone bridges in Central Park, New York City. The company lists building stone, fireplace stone, landscaping stone, flagstone, retaining wall stone, boulders and stone chips among its product line. It also produces blocks/slabs cut-to-size and carved sandstone, and has supplied clients as far away as San Francisco. Stone for restoration and new construction projects are actively pursued. A few of the projects recently undertaken have included Government House in Halifax, N.S., Old Government House in Fredericton, N.B. and other custom work in Ontario.

Smith Cut Stone and Quarries Limited

The address for Smith Cut Stone and Quarries Limited is P.O. Box 69, Shediac, New Brunswick E0A 3G0. Telephone: (506) 532-6902. The company is managed by Louis R. Drisdelle.

Smith Cut Stone and Quarries (or, more precisely, its antecedents) is the oldest existing stone company in New Brunswick. From the 1860s onwards, the company has been producing dimension stone from its olive green sandstone quarry (Figure 9: 36) as well as from other sources. Smith pursued the building stone market vigorously and within a few years the company secured many contracts to supply trim stone for brick buildings, and dimension stone for major structures across southern New Brunswick and (in one case) Québec.

One of the most highly regarded Acadian stonemasons, Arthur LeBlanc, became the quarry superintendent in 1934. Arthur oversaw stonework on most Smith contracts until well into the 1970s. In 1968, the entire stone enterprise was sold to Arthur's son and was incorporated as Smith Cut-Stone and Quarries Limited. After 1954, the company stopped using stone from its Shediac property and concentrated instead on cutting material from other sources such as Queenston limestone from Ontario, red sandstone from the Pickard quarry in Sackville, and sandstone from Wallace, Nova Scotia. The change occurred for several reasons.

From 1970 to 1980, the late Roy LeBlanc and his employees excavated stone in Sackville, cut it in Shediac, returning it to the Mount Allison University Campus to construct the Roy Crabtree Building. In 1981, LeBlanc leased another red sandstone quarry outside Sackville to supply material for the Confederation Square building in Toronto.

The Smiths' own Shediac quarry has been re-activated once since 1954 in order to supply stone for an addition to Moncton High School that was built of Shediac stone in 1934.

Today, the Smith Cut Stone and Quarries facilities operate on demand. Recent projects have entailed more restoration than new construction work. In 1988–89, the company fulfilled a joint contract with CanStone Inc. of Halifax to restore a portion of the Legislature Building in Fredericton.

Bastarache Stone Quarrie

Bastarache Stone Quarrie [Telephone: 856-9507] operates a sandstone quarry at Notre Dame, north of Moncton in southeastern New Brunswick (Figure 9: 37). Specializing in flagstone, the company has supplied material used as wall and patio stone for windowsills and fireplace hearths as well as general building stone.

Crushed Stone

Historically, aggregate from bedrock sources has been produced from ten to twelve quarries, the larger ones in the Moncton, Saint John, and Fredericton areas and the smaller ones near Havelock, Edmundston, Campbellton, Belledune, northwest of Miramichi, and west of Bathurst (Figure 9: 38–43). Both the Fredericton and Moncton areas are deficient in good quality, coarse, surficial, granular aggregate materials.

A preliminary estimate (Statistics Canada) of crushed stone production in New Brunswick during 1998 is 3 174 592 t with a reported value of $19 256 353 (Table 4). In comparison, 1997 production (final figure) was 3 933 882 t valued at $20 292 722.

Sand and Gravel

More than 60 companies produce aggregate from numerous sand and gravel pits and quarries throughout the Province. Most sand and gravel pits in New Brunswick are operated on an intermittent, on-demand basis. While many produce low-specification pit-run or borrow material, several companies produce good quality material from large deposits. These are more permanent operations that lie within economical trucking distance of high-demand urban areas. The pits and processing facilities of Lafarge Construction Materials at Blagdon, 25 km north of Saint John (Figure 9: 44) is one example. Because of the shortage of better quality material, there is a trend toward crushing bedrock that possesses appropriate specifications.

A preliminary estimate (Statistics Canada) of sand and gravel production in 1998 is 4 075 267 t. The 1997 final production figure for sand and gravel was reported to be 4 183 406 t.

A preliminary combined production estimate (Statistics Canada) for sand and gravel and crushed stone for 1998 is 7 249 859 t valued at approximately $26 000 000. Because of Statistics Canada's rather limited sampling of aggregate-producing operations in the Province, it is expected that actual production is considerably higher. Production of crushed stone and sand and gravel from New Brunswick Crown-owned pits and quarries during 1998 was 2 765 235.43 t (3 727 618 t in 1997), providing revenue to the Province in the amount of $682 607.94. In addition, quarry lease rentals amounted to $31 389 and application fees amounted to $3580.

HYDROCARBONS

Coal

N.B. Coal Limited

COMPANY N.B. Coal Limited, P.O. Box 520, Minto, New Brunswick EOE 1JO. Telephone: (506) 327-3336. The President is Mr. A. Cormier. The parent company is NB Power.

RIGHTS N.B. Coal Limited holds a Coal Agreement, under the *Mining Act*, Chapter M-14.1, S.N.B. 1985, in the Minto–Chipman area.

LOCATION The Minto–Chipman coalfield (Figure 9: 45) is approximately 60 km east-northeast of Fredericton (NTS 21 I/4, 21 J/1).

HISTORY (For early history see Miscellaneous Report 13, "New Brunswick's Mineral Industry, 1993.")

RESERVES 9 600 000 t of coal, proven.

PRODUCTION 272 362 t of coal (1998); 179 191 t of coal (1997)

EMPLOYEES 1998–99, an average of 101 persons.

DEVELOPMENTS N.B. Coal Limited operated for only 8 months of the year.

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Y

Z

ABBREVIATIONS

cm - centimetre
m - metre
km - kilometre
g - gram
t - tonne

L - litre
M - mega (prefix for 1000000)
t/a - tonnes per year
t/d - tonnes per day
ha - hectare

CONVERSIONS

Square miles (sq. mi.) x 2.589988 = square kilometres (km^2)

Short tons x 0.907184 = tonnes (t)

Acres (ac.) x 0.404685 = hectares (ha)

For precious metals:
ounces per ton (oz./ton) x 34.28571 = grams per tonne (g/t)

For oil (1 barrel = 42 U.S. gallons):
barrels x 0.1589873 = cubic metres (m^3)

For natural gas:
cubic feet (cu. ft.) x 0.02831685 = cubic metres (m^3)

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